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THE DEPARTMENT OF AGRICULTURE,

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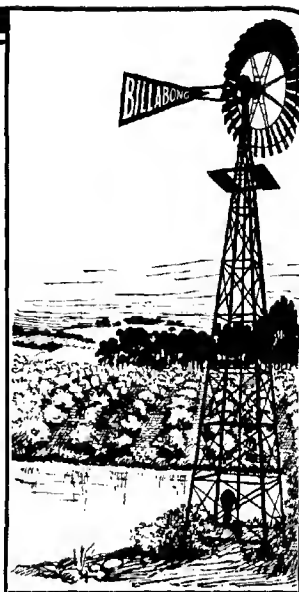
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THE JOURNAL
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BEE-KEEPING IN VICTORIA.

By F. R. Beuhne, Bee Expert.

(Continued from page 733, Vol. XII.)

XXVI.—THE HONEY FLORA (continued).

THE FRIZZY BOX (*Eucalyptus Baueriana*).

The Fuzzy Box, also known as Round-leaf Box, is closely allied to the Red Box (*E. polyanthemus*), of which it was formerly held to be a variety. It is found only in the eastern part of Victoria, particularly in the Lake Tyers and Tambo districts. In general appearance and habit of flowering it differs but little from Red Box.

As a honey producer it is, however, quite distinct from the latter, the honey being clearer, slightly less dense, and without the somewhat objectionable oily flavour of Red Box honey. Nothing definite is, so far, known as to whether bees gather pollen from the blossom.

THE MANNA GUM (*Eucalyptus viminalis*).

Fig. 11.

This Eucalypt, which is also known as White Gum and Ribbon Gum, is widely distributed over Victoria, but except on alluvial flats it does not appear to occur anywhere in large numbers together, but rather scattered, or interspersed, between other trees, such as Red Gum, Stringy Bark, Messmate, Blue Gum, and Swamp Gum (*E. paludosa*).

In open country it is not a tall tree, but when found in close forest of other Eucalypts it often attains great height and stem diameter. There is great variation in the appearance of the trunk of this tree in different localities, and sometimes even between individual trees growing side by side; a rough, hard bark generally covers the base of the stem, while the upper portion is usually smooth, and white in colour. During

the change of seasons the smooth portion of the bark becomes detached from the trunk in long strips, hence the name Ribbony Gum. In some specimens, however, the rough scaly bark persists to, or even partly, on the branches, while in others almost the whole of the trunk and branches are smooth and clean.

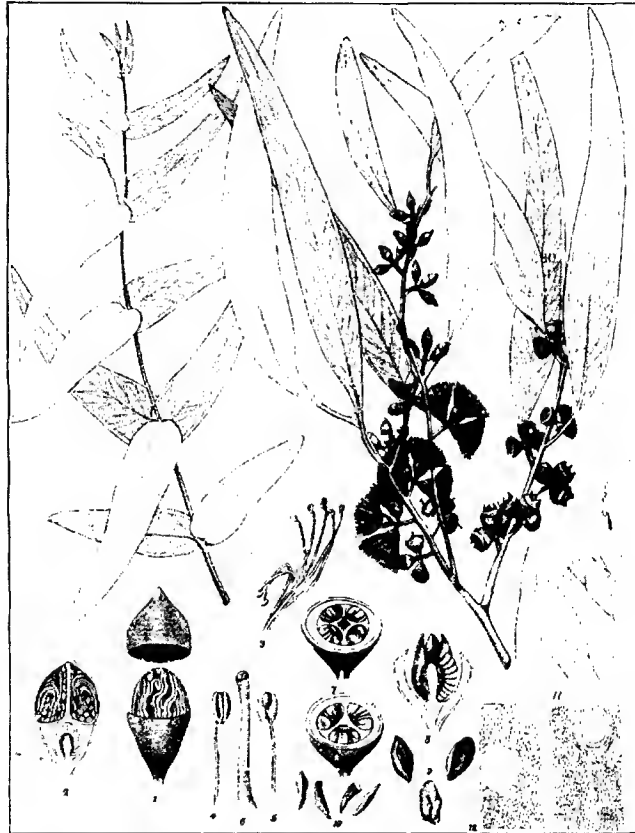


Fig. 11.—The Manna Gum (*Eucalyptus viminalis*, Labillardiere).

The leaves are long, lance-shaped, slightly curved, of the same colour on both sides, the veins rather faint, spreading feather-like, the marginal vein somewhat removed from the edge of the leaf. The umbels are generally, but not necessarily, three flowered, with the buds, flowers, or fruits in line. The buds are oval, more or less pointed, the fruits half-egg shape, with three, four, or, rarely, five cells.

The wood, which is from pale to brown in colour, makes good fire-wood, and is fairly durable when cut and seasoned, but the standing trees are apt to rot at the centre. When found at high elevations it yields a useful building timber.

This tree is well known on account of the manna it produces, usually during midsummer; it is, however, at times difficult to distinguish it from several others, such as Swamp Gum (*E. paludosa*) and Apple-Gum (*E. Stuartiana*), both of which it somewhat resembles. Reference to the illustrations, Figures 12 and 13, will, however, show that the sucker leaves of each are quite distinct, for while those of *E. viminalis* are narrow lance-shaped, with a roundish base, the sucker leaves of *E. Stuartiana* are roundish, and of *E. paludosa* egg-shaped.

The Manna Gum is somewhat irregular in its habits of flowering and the length of time it is in bud. Two generations of the latter may often be seen on the same branches of a tree, one which will blossom within a few months, and the other which may not do so for eighteen. The flowering most frequently occurs after that of Red Gum, but may occur almost any month of the year. As this tree does not grow in very large numbers in any one locality, it does not produce large and distinct yields of honey, but, owing to its flowering occasionally when other bee forage is scarce, and producing pollen as well as nectar, it is a very useful tree to the beekeeper.

The honey has a distinct sweetness of its own; is clear amber in colour, not very dense, and candies rather readily.

THE SWAMP GUM (*Eucalyptus paludosa*).

Fig. 12.

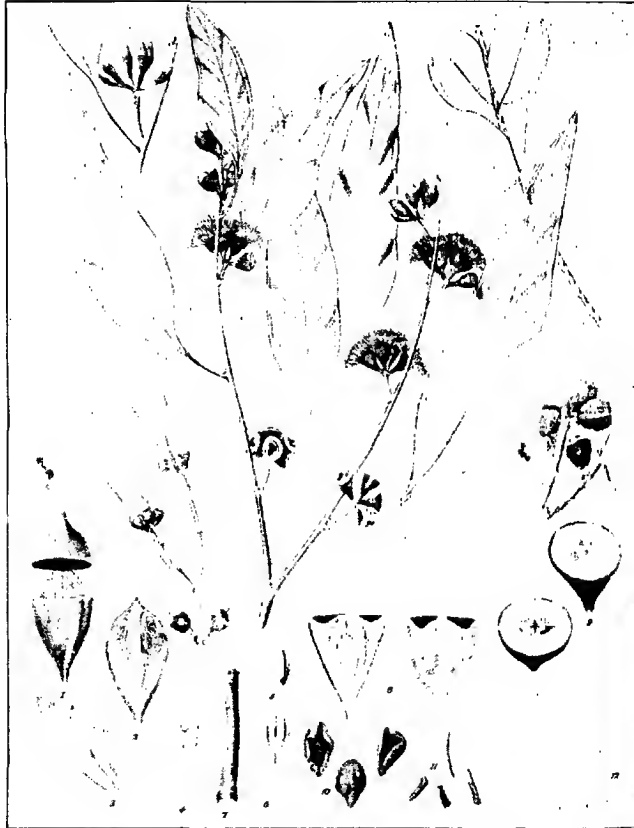
The Swamp Gum, Cider Eucalypt, White Gum, grows usually on alluvial flats, particularly in swampy places. It is generally not a tall tree, often of crooked growth, and sometimes dwarfed. In general appearance of the trunk and in the bark it resembles the Manna Gum to a certain degree. The bark is often rough, dark or greyish brown at the butt, and sometimes so up to the main limbs; in other cases, smooth on the stem and the branches, and greyish white in colour. The branches are very spreading. The wood is fairly hard, but as it is rarely straight not much used except for fuel. It makes excellent charcoal. The leaves are lance-shaped, rather pointed at the base, and of equal deep green on both sides, the veins rather distant, moderately spreading, and the marginal vein distinctly removed from the edge of the leaf. The sucker and seedling leaves are oval. The umbels occur singly at the shoulders of leaves, or laterally from the branchlets, and carry from three to ten flowers; the buds are egg-shaped, short pointed, the fruit top-shaped, three, four, or, rarely, five celled.

This tree flowers usually, not very profusely, in autumn; nothing definite is known yet as to the length of time it is in bud. Pollen is gathered from the blossom by bees. The honey is clear amber in colour, not dense, candies, and closely resembles that of Manna Gum. The Swamp Gum is distinguished from the Manna Gum by the broader and shorter leaves, their darker green, and more distant veins, the different grouping of the flowers, and the oval sucker and seedling leaves, as contrasted with the narrow lance-shaped ones of the Manna Gum.

THE APPLE GUM (*Eucalyptus Stuartiana*).

Fig. 13.

A medium sized tree, with widely spreading main branches, rarely attaining to 100 feet in height. It grows on rather sandy, and often in moist, tracts of country, on low ridges, and in grass tree country. It occurs in large numbers in the scrub country of the Grampians in company with Messmate, Stringy Bark, and Manna Gum, is of a spreading

Fig. 12.—The Swamp Gum (*Eucalyptus palulosa*).

habit, with the branchlets slender and drooping. The wrinkled brownish bark is rather scaly on the outside, but fibrous inside, somewhat resembling Stringy Bark, and continues, not only on the stem, but also on the main limbs. The trunk is generally twisted and gnarled rather than straight.

The leaves are scattered, lance-shaped, slightly bent, dark green on both sides; the veins are very thin and spreading, the marginal one removed from the edge; the umbels have usually more than three flowers; the buds are rounded, slightly pointed. The fruits are half-egg or top shaped, very small, oftener three than four celled.

As a somewhat smooth barked variety of this species also occurs it is sometimes mistaken for *E. riminalis*, the Manna Gum. The differences



Fig. 13.—The Apple Gum (*Eucalyptus Stuartiana*, F. v. M.).

which separate the two are given by F. v. Mueller in *Eucalypts of Australia* as follows: The Apple Gum (*E. Stuartiana*) is a more shady tree on account of its spreading habit, more numerous branches, and denser foliage. The leaves yield no manna, and have a more pleasant scent, reminding slightly of the odour of apples. The flowers are usually more than three in a cluster, which is the prevailing number in the case

of the Manna Gum. Further, the seedling and sucker leaves of the two trees are quite distinct, as will be seen on reference to the illustrations, Figures 11 and 13.

This tree has various local names, such as Apple Tree, Apple Gum, and, in the Grampians, Black Butt, on account of the blackening of the bark by periodical bush fires. It blossoms profusely from February to April, and is in bud for twelve to fifteen months. It is a very useful tree to the apiarist, as it flowers more or less every year and produces pollen as well as nectar. The honey is amber in colour, not very dense, and granulates more or less, but is very suitable winter food for bees.

THE LONG-LEAVED BOX (*E. elaeophora*) (*syn. E. Cambgei*).

This tree is found intermixed with other Eucalypts generally on poor soil and rocky hills, but also in more favorable situations in and around the Grampians, the Wimmera, Pyrenees, Upper Avoca, and the drier central part of the Dividing Range north of Melbourne, and in moister localities further east. It is known by many different names in different localities, such as Bastard Box, Apple Tree, Cabbage Gum, Grey Box, and even as Peppermint, to which latter (*E. amygdalina*) it bears no resemblance whatever. It is a stunted tree, rarely straight, seldom up to 3 feet in diameter. The bark, which is thick, but not fibrous, covers the trunk and larger branches; it is from light grey to brown in colour, fairly even sometimes, but rough, harsh, and furrowed in some localities. The wood is coarse, from light to dark-brownish grey in colour, the sap wood often very thick. As a timber it is almost useless, decays rapidly, and is even of little value as fuel.

The leaves are long, lance, and slightly sickle-shaped, of equal color on both sides, the veins thin, moderately spreading, the marginal vein somewhat removed from the edge; the flower stalks are broadly compressed, the buds markedly angular, with a conical pointed lid, are in single umbels of from four to seven flowers; the fruits are half egg shaped, lined by two to four angles, and three or four celled.

The Long-leaved Box is easily distinguished from other Eucalypts, in the company of which it is found by its angular buds and fruits. Till recently this tree was considered to be a dwarf variety of the Mountain or Grey Gum (*E. goniocalyx*) (Fig. 14), which is very similar in leaf, flower, and fruit, but very distinct in general appearance. Since classification of the Long-leaved Box as a distinct species, the botanical name, *E. goniocalyx*, should now be dropped by bee-keepers in favour of *E. elaeophora*.

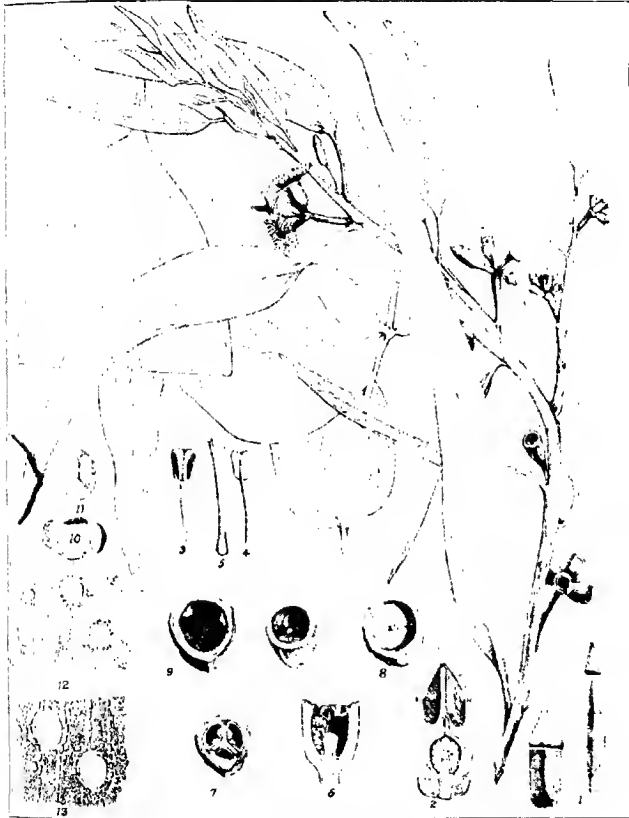
From a bee-keeper's point of view this is in several respects a remarkable tree. It flowers at irregular intervals of four, five, or more years, but then often two years in succession. It is probably longer in bud (eighteen to twenty-one months) than any other Eucalypt; it is a prolific yielder of pollen for bees. It blossoms from March, often right through the winter. The honey is dark, but of fair flavour, and bees invariably winter well on it; it caudies coarsely, but not hard.

GREY GUM OR MOUNTAIN GUM (*Eucalyptus goniocalyx*).

Fig. 14.

As mentioned above, the botanical name, *E. goniocalyx*, is now applied to the Mountain Gum only, which also passes under the vernacular names of Mountain Ash, Grey Gum, White Gum, Spotted Gum, and

Bastard Blue Gum. As already indicated, it is almost identical with the Long-leaved Box in leaf, flower, and fruit, but, as distinguished from the latter, it is a tall, straight tree, occasionally exceeding 200 feet in height and attaining a stem diameter up to 6 feet; the wood is hard and tough, varies in colour from a pale yellowish to a brownish colour; it is very durable, and lasts well underground; it is used by wheel-



The Mountain Gum (*Eucalyptus goniacalyx*, F. v. M.).

wrights and in boat building, for railway sleepers, planks, piles, and general building purposes.

Of its nectar and pollen yielding properties nothing is yet known, but it is here enumerated to distinguish and separate it from *Eucalyptus elacophora*, the Long-leaved Box.

(To be continued.)

ANNUAL GRANT TO AGRICULTURAL SOCIETIES.

SUBSIDY CONDITIONS FOR 1915.

CONDITION A.—COMPULSORY.

The awards of prizes in all classes for stallions three years old and over at the Society's Show must be subject to the possession by the exhibit of a Government certificate of soundness.

Stallion Inspection Parades will be held at different centres throughout the State prior to the commencement of the Show season (Time Table of Stallion Parades for 1915 will be available shortly after 1st April, 1915). The parade centres are so arranged that all owners of Show stallions have the opportunity of submitting them for examination for the Government Certificate of Soundness before the closing of entries for the Show. Show Secretaries will require to obtain evidence of the possession of the Government Certificate in respect of exhibits at the time of entry, and should not accept entries of other than certificated horses.

Immediately after the Show, Secretaries of Societies are required to forward the names of *all the horses* that have won the prizes in stallion classes, together with the names of the owners, to the Director of Agriculture.

Failure to comply with the above requirements will result in forfeiture of the grant in aid.

CONDITION B.—OPTIONAL.

AGRICULTURAL CLASSES.

A sum of £10 as a special subsidy will be added to the *pro rata* grant to such Societies as carry out agricultural classes in strict conformity with the following conditions and to the satisfaction of the Department:—

Applications must be submitted not later than 1st March, 1915.

Thirty students at least must be enrolled before a class can be held.

The rent of hall and all local charges are to be paid by the Agricultural Society; all other expenses by the Department. Arrangements must be made to insure the uninterrupted use of the hall during the time the lectures are going on.

A roll of attendances at lectures and demonstrations shall be kept.

The agricultural classes will extend over two weeks, a demonstration being given each morning and afternoon, and four limelight lectures on evenings to be arranged for by the Secretary of each Society.

At the conclusion of each class, a written examination of about 1½ hours' duration will be held, provided at least five students remain for examination, and the student securing the highest number of marks for examination work and regular attendance combined will be eligible to compete at a final examination of successful students from the various

centres at which the classes have been held. The successful competitor at the final examination will be awarded the gold medal offered by the Australian Natives' Association, provided there are at least five competitors. The Department will grant free railway tickets to students attending the final examination.

Students in attendance at Agricultural High Schools and Colleges, or at the Continuation Schools, and teachers from such institutions or State Schools shall not be allowed to sit for such examination.

Subjects of First Week.

Agriculture.

Live Stock and Veterinary Science.

Subjects of Second Week.

Two or more of the following, to be selected:—(a) Sheep Breeding and Management (including Wool Classing and Lambs for Export); (b) Dairy Farming (including Management and Breeding of Pigs); (c) Poultry Breeding and Management; (d) Horticulture, Orchard and Garden Work, Viticulture.

LECTURES.

A special subsidy of £1 5s. per lecture will be added to the *pro rata* grant to such Societies as arrange for and carry out lectures throughout the year in strict conformity with the following conditions and to the satisfaction of the Department:—

No Society will be allowed subsidy on more than four lectures.

Applications must be submitted not later than 1st March, 1915, and accompanying the application must be a list of the subjects (see page 74) which the Society chooses. The dates of lectures will then be fixed by the Department, and if Societies will state the most suitable seasons for their districts the lectures will, as far as possible, be arranged accordingly.

An attendance of at least fifteen *bonâ fide* farmers, farmers' sons or farm hands will be required, otherwise the lecture will not count for the special subsidy. In case of failure to secure such attendance another lecture will not be substituted, nor will any subsequent lectures that may have been arranged be given.

The President or Secretary or a member of the Council or Committee of the Society must take the chair at each lecture, and must certify as to the number and *bona fides* of the attendance as above required.

The rent of the hall, advertising, and all other local charges are to be paid by the Agricultural Society; all other expenses by the Department.

The Department will recognise any suitable lecture, paper, or address that a Society may arrange to have delivered by any person other than a Departmental officer, and the special subsidy of £1 5s. will be allowed for each such lecture, provided due notification prior to

delivery of lecture is given, and the President of the Society afterwards certifies as to *bona fides* and suitability of the lecture and the number and character of the attendance.

SYNOPSIS OF LECTURES AND DEMONSTRATIONS.

PRINCIPLES OF AGRICULTURE.

1. The plant food of the soil.
2. Cultivation methods and management.
3. Principles of manuring.
4. Valuation of artificial manures.
5. The management of the farm.
6. Special crops and catch crops.
7. Irrigation principles and methods.
8. Factors in successful wheat cultivation.
9. Results of experimental work.

VETERINARY SCIENCE AND LIVE STOCK SUBJECTS.

1. The structure and care of the horse's foot (lantern).
2. Brood mares and breeding mishaps (lantern).
3. Colic, constipation, and other bowel complaints.
4. Ailments of dairy cows—milk fever, impaction, udder complaints.
5. Contagious diseases of stock—abortion, blackleg, tuberculosis, anthrax, pleuro pneumonia, &c. (lantern).
6. Ailments of swine, or ailments of sheep.
7. Unsoundness in horses (lantern).
8. Principles of stock breeding—stud horses (lantern).
9. Teeth of the horse—age, defects (lantern).
10. Injuries to farm animals—first aid.
11. Principles of shoeing (lantern).

DAIRY FARMING.

1. Breeding and management.
2. Dairy buildings—silos and silage.
3. Dairy management.
4. Milk and cream testing.
5. Foods and feeding.
6. Pig breeding, feeding, and management.
7. Cheese making.

APICULTURE.

1. The honey industry—handling bees.
2. Breeding and management.
3. Diseases of bees—methods of control.

POULTRY BREEDING AND MANAGEMENT.

1. Incubation—natural and artificial—the rearing of chickens.
2. Breeds: payable or otherwise, table and export, eggs—how to select stock.
3. Turkeys: their care and management. Duck raising and care.
4. Foods and feeding, with practical demonstration—mixing the mash.
5. Common ailments of poultry.

ORCHARD AND GARDEN WORK.

1. Fruit growing—Varieties suitable to the different localities, soils and sites.
2. Preparation of land—Planting and pruning.
3. Cultivation—Manning and management.
4. Insect pests and fungus diseases and their treatment.

THE FRUIT INDUSTRY.

1. Handling, packing, grading, and marketing of fruit for export and local trade.

VITICULTURE.

1. Establishment of vineyard.
2. Phylloxera and resistant stocks—Preparation of land.
3. Propagation and grafting—Best varieties to grow.
4. Pruning and seasonable operations.
5. Wine-making and cellar management.
6. Drying raisins, sultanas, and currants—Fresh grapes for export.
7. Vine diseases and treatment.

SUBJECTS AND STAFF.

Principles of Agriculture—Mr. A. E. V. Richardson, M.A., B.Sc.; Mr. Temple Smith.

Veterinary Science, Stock Management, Dairy Sanitation and Education—Messrs. W. A. N. Robertson, B.V.Sc.; E. A. Kendall, B.V.Sc.; R. Griffin, M.R.C.V.S.; R. N. Johnston, B.V.Sc.; R. J. de C. Falbot, L.V.S.

Dairy Farming—Mr. R. T. Archer and staff of Dairy Supervisors.

The Dairying Industry and Export Trade—Messrs. R. Crowe and P. J. Carroll.

Orchard and Garden Work—Messrs. P. J. Carmody, H. W. Davey, and E. E. Pescott.

Sheep Breeding and Management—

Viticulture—Mr. F. de Castella.

Flax Culture and Demonstrations at Shows—Mr. J. E. Robilliard.

Poultry Breeding and Management—Mr. A. V. Rintoul.

Poultry Dressing Demonstrations—Mr. A. Hart.

Potato Culture—Mr. J. T. Ramsay.

Tobacco Culture—Mr. Temple Smith.

Pig Breeding and Management—Mr. R. T. Archer.

Fruit Industries—Mr. E. Meeking.

Insect Pests—Mr. C. French, Junr.

Plant Diseases—Mr. W. Laidlaw, B.Sc., and Mr. C. C. Brittlebank.

Irrigation—Expert of State Rivers and Water Supply Commission.

Apiculture—Mr. F. R. Beuhne.

Cheese Industry—Mr. G. C. Sawers.

S. S. CAMERON,
Director of Agriculture.

THE WALNUT.

(Continued from page 756, Vol. XII.)

C. F. Cole, Orchard Supervisor,

CULTIVATION.—SOIL TREATMENT.

The amount of soil stirring necessary for a walnut grove to conserve moisture during the drier periods of the year, and to keep the soil in as good a mechanical condition as possible will be controlled largely by climatic and the physical conditions of the soil.

The moisture retaining power varies considerably in soils, evaporation being quicker from some than with others.

Soils that cake upon the surface after rain or artificial waterings generally dry out quicker than those soils of a loose, friable nature that do not do so.

To retain the soil moisture with this former class of soil it is necessary to keep the surface well broken, and in a fine state of tilth during the warm and dry periods of the year. In regions where the rainfall is limited during summer, systematic cultivation should be practised to retain the soil moisture.



Fig. 16.—Partial view of Walnut grove, Eurobin. Mt. Buffalo in background.

During the past summer and autumn of the year, 1914, walnut trees growing in regions that usually receive an abundant rainfall suffered severely from the want of soil moisture. The result is that the nuts were smaller than usual, the meat (kernel) being of poor quality. In many instances a great percentage of the nuts had the meat shrivelled and were valueless. With some trees the whole crop shrivelled and fell. Apart from the trees producing nuts of inferior quality, the foliage suffered sun-burn, and prematurely fell. Such conditions are not conducive to the health of the trees and profitable nut production.

Figure 16 shows portion of a walnut grove planted upon a river flat in a locality usually receiving an abundance of moisture, yet during the past summer and autumn, 1914, the trees felt the dry conditions.

The low level of the river also greatly increased the depth of the water table from the natural soil surface. If deep spring ploughing had been carried out, followed up by systematic surface soil stirring, not only would the evaporation of moisture from the soil have been retarded, but the general conditions of the soil greatly improved. Apart from the value of conserving soil moisture, systematic cultivation should be practised in the groves, if not generally through the whole area, then around the trees.

It is a common sight in this State to see walnut trees growing in the most suitable localities showing signs of general debility at an age when they should be vigorous and most productive. Such a condition is brought about, no doubt, not so much from the want of soil moisture, as from the lack of systematic cultivation. The soil, from the want of stirring, becomes sour, and falls back into its natural grass state.

Where the walnut is grown under irrigated conditions the surface soil when sufficiently dry should be stirred and reduced to a fine tilth after each watering. Cultivating soils too soon after watering is harmful, for instead of breaking down the surface soil to a fine tilth the wet soil particles are worked together and become consolidated. The time that soil stirring should follow after waterings will be controlled by the texture of the soil and its water-retaining powers.

IRRIGATION.

As already stated, to grow the walnut successfully the trees must receive abundant moisture, whether by artificial waterings or natural rainfall. Being a deep-rooted tree, constant irrigation is not necessary. In suitable moist districts where the rainfall is up to the average, sufficient moisture can be retained in the soil by systematic cultivation during the drier periods of the year. Yet even in such moist districts periods of drought are experienced at times, and it is during such dry periods that a supply of water is of great value, not only as an insurance against a poor crop, but it is of the utmost value to the rapid growth and early nut production of young trees. (See Fig. 2*.) In warm districts it is useless to think of growing the walnut profitably without irrigation. The period that the trees usually suffer mostly from the want of moisture is from the month of January to early winter. Under normal conditions on irrigable lands heavy waterings should be given during these periods, so that the subsoil will be thoroughly soaked and not allowed to become dry during the autumn and winter months. This insures healthy conditions in the trees, and stores up enough moisture in the subsoil for the following spring and early summer months.

PRUNING.

Up to the present time in Victoria there exists a strong opinion amongst persons conversant with the walnut tree that no pruning is necessary, and that the trees should be left entirely to themselves from the time they are planted out permanently, allowing them to form their own symmetrical shape, which shape the walnut has a strong tendency to develop if left alone.

Although the walnut may require very little cutting during its early stages of development, it being only necessary at times to remove a small bough to equally balance and counteract a one-sided growth, it still remains an open question that if systematic light pruning was

* *Journal of Agriculture, Victoria, August, 1914, p. 457.*

practised whether it would not be found profitable, and more beneficial than injurious, particularly to old and fully matured trees. The old adage, that the more one flogged a walnut tree the better it would be, no doubt had its one-time value, although performed and carried out in a very crude manner.

The walnut is a true deciduous tree, *i.e.*, shedding all its foliage in late autumn, and reproducing it again in the spring, carrying it right through the summer months to the following late autumn or early winter. The tree produces two classes of flowers known as the staminate and pistillate, *i.e.*, male and female (see Plate 17). The staminate



Plate 17.—A. Catkins from first season's growth.

B. Pistillate flowers upon tips of young spring growths.

X. Indicates where growth was cut.

blossoms are borne on long pendulous catkins, which develop in the spring from naked buds formed upon the past season's growth. These catkins contain a light yellowish-coloured fertilizing dust correctly termed pollen, which is carried by the wind and other agencies to the pistillate (female) or fruiting blossoms, which are produced upon the tips of young spring growths, such growths springing from the terminal buds on the previous season's growth. The pistillate bloom or immature nuts contain feathery stigmas that catch the fertilizing dust (pollen), and after pollination has taken place, the feathery stigmas die away,

and the pistillate flowers develop into nuts. Therefore, we find that the nuts are produced upon the tips of the young spring growths alone. This, in other words, means that if a walnut tree is to be prolific it is essential that the tree should make sufficient suitable healthy spring growths each season. If a growth producing the nut or nuts is not injured the terminal bud upon such growth shoots forth during the following spring. Usually this spring growth upon aged trees is less vigorous and much shorter than that upon strong, vigorous and younger trees. Now if this nut-producing growth is broken at the terminal end or cut lightly back after the crop in the autumn or winter months, the results are that one, two, or probably more, of the buds nearest the terminal end of the injured growth are stimulated into action and burst forth, making strong, fresh spring or nut-producing growths the following spring.



Plate 18.—Developing an ill-shaped tree.



Plate 19.—Removal of growth, correct method.

No doubt the object of flogging the walnut trees was a rough method of producing upon aged trees a more vigorous and a greater quantity of spring or nut-bearing wood growths, thereby increasing the crop. Many growers still maintain that flogging the tree to harvest the crop has a beneficial effect upon the future season's crop.

X indicates upon Plate 17 where a growth was reduced slightly back upon an aged tree in the autumn of 1913, and by the spring of 1914 there are three nut-producing growths. Experiments carried out by the writer upon portion of an aged tree was favorable to judicious light pruning and thinning out. There is plenty of room for experimenting, both in regards to thinning out the overcrowded growths upon aged trees, cutting lightly back the growths that produce the nuts, and whether annual or longer periods of pruning is the better course to

adopt. If it is proved beyond doubt that judicious pruning is advantageous to the walnut it is questionable if it would be put into practice owing to the great height and size the trees attain under favorable conditions.

Aged debilitated trees that came under the notice of the writer had been judiciously reduced back and were found to have made strong vigorous growths, the rejuvenation of the trees was highly satisfactory. There is little doubt that light pruning and the removal of overcrowded branches is just as beneficial to the walnut tree as to fruit-producing and other trees by stimulating old and forming new growths, and allowing free access of light and air to the inner branches of the trees.

When it is necessary to cut young trees so as to keep them growing in good shape, it is advisable to perform the operation during the early vegetative or active period of the tree—about late spring or early summer. Plate 18 shows a young tree that was reduced back in the winter or dormant months of the tree. The terminal shoot is seen making a somewhat weakly, undesirable oblique growth that if left unremoved would probably be the means of forming an ill-shaped tree. Whilst the lower shoot has come away in a vertical position, making a strong vigorous growth carrying healthy laterals, that will ultimately make strong lateral branches to a fine symmetrical tree.

By cutting away this oblique growth whilst the tree is active, not only is the callusing over of the wound quicker, but the rapid forward growth of the tree in forming its head prevents largely the pushing out of any strong shoots lower down, which very often occurs following winter cutting, and if the lower shoots are neglected probably one will predominate, and making strong rapid growth, will starve those above, and be the means of making an ill-shaped tree.

All shoots that push out below those not required to frame the head should be removed, either with a sharp knife, or rubbed off with the thumb and forefinger, before they reach any length and become hardened. If cutting is practised in the winter, there is a greater risk of upsetting the balance of growth. All cuts should be made neatly and cleanly, and painted over with wax. See Plate 19.

(To be continued.)

PROTEINS from various sources differ in character, and cannot be regarded as being of equal value in feeding. It is often good policy to mix the feeds.

BONES were first used on Cheshire pastures at the rate of 30 to 35 cwt. per acre. They were broken to 1 inch and $\frac{1}{2}$ inch sizes, but modern science has improved on this.

THE colour of superphosphate is a matter of indifference. What the purchaser has to note is the percentage of soluble phosphate, and the mechanical condition.

PLANTING AND RECONSTITUTION OF VINEYARDS.

CONDITIONS GOVERNING THE DISTRIBUTION OF PHYLLOXERA-RESISTANT VINE ROOTLINGS AND CUTTINGS.

In order to guard against misunderstandings, such as have occasionally arisen in the past, concerning the conditions subject to which intending planters of vineyards may purchase phylloxera-resistant vines from the Department of Agriculture, it is deemed advisable, in the present issue of the *Journal*, to clearly state these conditions.

Similar information, published early last year, proved most useful, and was the means of preventing confusion.

It may not be out of place to here remind applicants that the Department is situated very differently from a private nursery firm, which conducts its operations for profit. The propagation and grafting of resistant stocks were undertaken solely in order to help the Victorian vine industry through the phylloxera crisis, by which it was threatened with extinction. Numerous difficulties have had to be surmounted, and considerable sacrifices have been made, vines being supplied to growers at a price which amounts to less than half of what it costs to raise them. In order to prevent disappointment, and to insure the help and co-operation of growers, conditions have been drawn up which intending applicants are earnestly requested to thoroughly familiarize themselves with. *They are warned that under no circumstances can any departure be permitted from the regulations governing the distribution as detailed below, nor can any request for special consideration be entertained.*

While every care will be exercised to supply vines and vine cuttings true to name, no pecuniary liability can be incurred by the Department in the event of possible error. Vines (including cuttings) will only be despatched subject to such reservation.

Resistant vines are supplied to intending planters in either of the following forms, and at the prices stated:—

Resistant rootlings, grafted with scions previously supplied by applicants, at per 1,000, £6.

Resistant rootlings, ungrafted, at per 1,000, £1 10s.

Resistant cuttings, at per 1,000, 15s.

The conditions which applicants have to comply with necessarily vary for each of these. Before detailing them, the two methods by which a vineyard on resistant stocks can be established may be briefly outlined, mainly for the information of settlers in new districts. These are—

I. Field grafting of resistant rootlings, planted the year before.

II. Planting of nursery-raised grafted rootlings or bench grafts.

Field grafting implies the planting of the vineyard with ungrafted rootlings, which are grafted, the year following their plantation, with scions of the vine variety it is desired to obtain fruit from. Sometimes cuttings are planted instead of rootlings, but unless the season be a very favorable one, results are usually disappointing.

Plantation of Grafted Rootlings.—The term "bench graft" is due to the grafting being performed at a bench or table, in a workshop; the resistant cuttings thus grafted with European scions being subsequently callused in artificial heat and struck in a nursery.

Field grafting is the older method. In Europe it has been very largely superseded by the plantation of grafted rootlings, a more even vineyard being thus obtained in climates where a cold Spring is the rule; cold, wet weather causing many field grafts to fail. In the more temperate climate of Northern Victoria far more satisfactory results can be relied on, and field grafting can be confidently recommended to intending planters. Some practical vine-growers who have tried both methods on a large scale claim to have obtained equal, if not better, results from field grafting.

A common fallacy concerning field grafting must here be corrected. It is often thought by intending planters that they gain a season by planting already-grafted vines. This, however, is not the case. The already-grafted vine cannot bear fruit before the third season from plantation. The field grafted vine commences to bear fruit the second season from grafting. If planted on properly prepared land, field grafting can be executed the season following plantation; it therefore follows that such vines will commence to bear the third season from planting, or just as soon as the already-grafted vines, planted at the same time.

SELECTION OF SCIONS.

Scions for bench-grafting must be supplied by applicants for grafted rootlings, as will be pointed out presently; but it is well to here urge on intending planters the very vital importance of careful selection of scions, whether these be intended for bench or field grafting.

The improvement of the fruit-growing capacity of a variety by means of careful selection of cuttings is no new discovery; it has repeatedly been recommended by different officers of this Department,* and its importance is now very generally recognised. It is a point, however, which was for many years much neglected by the majority of Victorian vine-growers, with the result that several of our vine varieties show more or less marked deterioration in their yield of fruit.

In order to secure prolific scions, the best individual vines in a block of any given variety should be carefully marked—quality and quantity of fruit, as well as general health and vigour, are the essential points to be considered in the selection of these scion-bearing vines, which may best be carried out immediately before vintage. Only fruit-bearing canes on the vines thus selected should be used as scions.

APPLICATION FORMS.

No application will be entertained unless made on the forms supplied for the purpose, which are obtainable from the Director, Department of Agriculture, Melbourne, or from the Principal, Viticultural College, Rutherglen.

Separate forms are provided for (a) Grafted Rootlings (pink form). (b) Ungrafted Rootlings and Cuttings (yellow form). Applications must be filled in on the proper forms.

* See *Journal of Agriculture, Victoria*, 8th March, 1906, page 189.

APPLICATIONS FOR GRAFTED ROOTLINGS FOR DISTRIBUTION, 1916.

(For the 1915 distribution, the time for receiving applications closed on 31st May, 1914, and present applicants cannot be supplied till 1916.)

1. For the 1916 distribution (June to August inclusive) applications, on the official forms (see above), must be made before 31st May, 1915, after which date they cannot be entertained.

2. Applications may be made to the Director of Agriculture, Department of Agriculture, Melbourne, or to Mr. G. H. Adcock, Principal Viticultural College, Rutherglen. They must be accompanied by a deposit at the rate of £1 per 1,000 grafted rootlings ordered. In the event of the allotment not being equal to the number applied for, the excess deposit will be applied as a progress payment for those delivered.

3. Scions for grafting, to the number of rootlings applied for and selected as described above, must be delivered by applicants at the Wahgunyah Nursery, or at the Wahgunyah railway station, freight prepaid, between 1st and 30th June, 1915. They must be of medium thickness (minimum diameter at small end $\frac{1}{4}$ inch and maximum at large end $\frac{1}{2}$ inch), and must be delivered in fresh condition and in good order.

4. On orders for small lots (less than 500 of one scion or stock variety) a surcharge must be paid, to cover cost of extra supervision, of 25 per cent. for lots of 100 and over, and of 50 per cent. for lots below 100.

5. Applicants who supply resistant cuttings (stocks) as well as scions will be entitled to the full number of the grafts which strike.

6. Prior to distribution applicants must submit the land they intend to plant to inspection, as no grafts will be distributed unless the Department is satisfied that they will be planted on properly-prepared land.

7. The number of grafted rootlings applied for will, before being approved, be subject of adjustment after inspection as provided in the next preceding rule, and in the event of the approved number applied for exceeding the number available, distribution will be *pro rata* of the adjusted and approved quantities.

8. Applicants must pay the balance of purchase money, as specified above, together with cost of packing (of which they will be notified) before the grafts can be forwarded.

9. Applicants must complete the purchase, and either arrange for their vines to be forwarded or take delivery of them at the nursery before the 15th September. Any vines left at the nursery after that date will revert to the Department, and any deposit or purchase money paid on account of same will be forfeited by the applicant.

10. The nurseries in which grafted rootlings are raised being situated in phylloxera districts, these cannot be supplied to growers in clean districts. To do so would be manifestly unfair to owners of existing vineyards in such districts.

APPLICATIONS FOR UNGRAFTED ROOTLINGS.

1. For the 1915 distribution (July and August inclusive) applications will be received until 30th June, 1915.

2. Applications may be made to the Director of Agriculture, Department of Agriculture, Melbourne, or to Mr. G. H. Adcock, Principal Viticultural College, Rutherglen. They must be made on the official

order forms (see above) and must be accompanied by a deposit at the rate of 10s. per 1,000 ungrafted rootlings ordered. Payment in full at the rate of £1 10s. per 1,000, with cost of packing added, must be made before the vines can be delivered. In the case of such final payment not being made the deposit shall be forfeited.

3. Orders for small lots (under 500 of any one variety) to pay a surcharge of 25 per cent. for lots of 100 and over, and of 50 per cent for smaller lots.

4. Should the number applied for exceed the number available, distribution will be made *pro rata*.

5. Applicants must complete the purchase and either arrange for their vines to be forwarded or take delivery of them at the nursery before 15th September. Any vines left at the nursery after that date will revert to the Department, and any deposit or purchase money paid on account of same will be forfeited by the applicant.

6. Rootlings cannot be sent from nurseries in phylloxerated districts to clean districts. A limited number of clean rootlings are, however, available for distribution to clean districts. The price charged is £2 per 1,000, packing extra. Applications for these will be received by Mr. F. E. Pescott, Principal, School of Horticulture, Burnley, until 13th June, 1915.

APPLICATIONS FOR CUTTINGS.

In the event of not being able to purchase sufficient rootlings (grafted or ungrafted), applicants are reminded that cuttings are available. These may be either planted out immediately in the situation which they are intended to permanently occupy, or they may be previously struck in a nursery; the latter is the course recommended. The distribution of resistant cuttings is subject to the following conditions:—

1. In view of the urgent demand for grafted rootlings, no cuttings of sufficient diameter to be grafted are available for sale. Resistant cuttings of less than $\frac{1}{4}$ inch in diameter at the small end will be supplied at 15s. per 1,000.
2. Applications for such cuttings, for delivery in July and August, 1915, must be made prior to 30th June, 1915, on the official order forms (see above).
3. Applications may be made to the Director of Agriculture, Department of Agriculture, Melbourne, or to Mr. G. H. Adcock, Principal of the Viticultural College, Rutherglen. Payment in full, at the rate of 15s. per 1,000, must accompany the order. This amount to be forfeited if delivery is not taken. Where cuttings are required to be sent a long distance and packing is necessary the cost will be advised and must be remitted prior to consignment.
4. Clauses 3, 4, and 5 of the regulations concerning ungrafted rootlings apply also to cuttings.
5. Cuttings from phylloxerated districts cannot be sent to growers in clean districts. A limited number of cuttings are available in districts free from phylloxera, and these can be obtained subject to the conditions specified above, but at the increased price of £1 per 1,000.

SWEET WINES OF MODERATE ALCOHOLIC STRENGTH.

By F. de Castella, Government Viticulturist.

A visitor to Australia from Southern Europe cannot fail to be struck by the radical manner in which the requirements of the average Australian wine drinker differ from those of the inhabitants of any of the wine producing countries of Europe.

In France, which is the largest wine consuming country, in Italy, Spain, Portugal, &c., dry wine of low alcoholic strength (from 14 to 18 per cent. proof), often diluted, in the glass, with water, is the usual beverage with meals, just as tea is in Australia.

To the English wine drinker, Spain, Portugal and Italy are best known by their Sherries, Ports, Madeiras, Marsalas, &c., more or less sweet wines of high alcoholic strength. To the inhabitants of the countries where they are produced, however, such wines are practically unknown. They are grown almost exclusively for export, mainly to Great Britain, the types having been evolved to meet the requirements of the cold English climate. It is, perhaps, not generally known that Port is not consumed to any extent in Portugal; the Portuguese drink *Vinho verde*, *Collares*, and other wines more similar to those of France, dry and of low alcoholic strength. Likewise in Spain—Sherry and Malaga are grown and matured for exportation, but light wines, both common, and of better quality such as "Rioja," which are scarcely ever heard of outside of Spain, meet the requirements of the Spaniard, who is, incidentally, one of the most temperate men in the world. In these, and in fact in all the countries of Southern Europe, wherever viticulture is possible, wine is the beverage taken with meals—drinking between meals is the exception, not the rule.

In Australia, the drinking of wine at meal time is quite unusual. Wine is either consumed in the wine shop—between meals—or an occasional glass may be taken at odd times from a bottle supplied by the grocer, often as a tonic prescribed by the doctor. Exact statistics are not available, but it would appear that the wine shop and the grocer retail between them something like 75 per cent. of our total wine consumption, and of this the great bulk is sweet. There is no doubt that the average Australian has a "sweet tooth." To his tea he adds large quantities of sugar, and what little wine he does drink must likewise be sweet. The "Port type" which he mostly favours is made on similar lines to its well-known European prototype. In this and such wines as Muscat, Frontignac, &c., the characteristic sweetness is due to a remnant of grape sugar, the fermentation of which has been prevented by the addition of sufficient wine spirit to increase the strength to a point at which further fermentation is impossible. In other words, sweetness is retained by "impounding" a certain proportion of the natural sugar of the grape by adding wine spirit, before the completion of fermentation. The alcoholic strength of such wines is necessarily considerable, rendering them, in the opinion of hygienists, less suited for consumption in our warm climate than in colder Britain.

French authorities distinguish between *Vins de Liqueur*—in which the alcohol is partly added—in short, fortified wines, and *Vins Liqueureux*, containing a more or less considerable quantity of grape sugar which has escaped fermentation, and a proportion of alcohol, wholly derived from the transformation of the sugar of the original must—in other words, unfortified sweet wines.

The part of mentor is always a thankless one, especially in regard to what one eats or drinks; nor is it desired to in any way discredit the sweet wines we now so largely produce. One might as well condemn the celebrated Ports of the Alto Douro (Portugal), recognised by all competent judges to rank amongst the world's finest wines. In Victoria we have produced, and are still producing, admirable wines of this and similar types—wines which are in no way less wholesome than the most celebrated Port. If the demand for such wines is keen—a heritage, no doubt, from our English forefathers—it is but legitimate business to supply such a demand.

The object of the present article is to draw the attention of our wine-makers to a few European sweet wines which belong to another class. They are quite distinct from the sweet wines we most largely produce in Australia; and are of far lower alcoholic strength than Ports and Sherries, and consequently better suited for extensive consumption in a warm climate such as ours.

They present another important advantage, that of being more economical to produce. Every additional degree of alcoholic strength means a corresponding increase in the cost of production. A wine of a strength of, say, 33 per cent. (proof) costs, roughly, 50 per cent. more to make than one of 22 per cent. In other words, a ton of grapes capable of yielding 120 gallons of wine at 22 per cent. would only yield 80 gallons if made at 33 per cent. In the latter case, a portion of the wine first made would need to be distilled, the spirit derived therefrom being used to increase the strength of the balance. If the 33 per cent. wine were sweeter than that at 22 per cent., the yield per ton would be still further reduced.

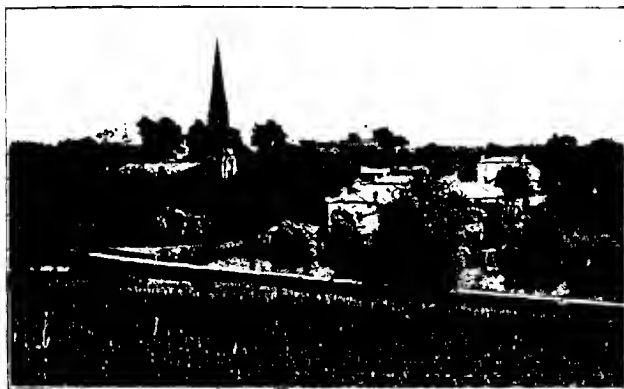
The advantages outlined above are such that the production of these moderately alcoholic sweet wines undoubtedly constitutes a potential field, at least worthy of serious consideration and experimentation—a field which, curiously enough, has scarcely as yet been exploited by us, though it can undoubtedly provide the means of satisfying the demand for sweetness so strongly evident in Australia, whilst supplying a wine of considerably lower alcoholic strength than is possible in the case of Port and other kindred types.

Some twenty years ago sweet wines of fairly moderate strength were often met with in the retail trade, in which fermentation was stopped, and the sugar necessary for sweetness was impounded by means of salicylic acid. Such wines were, in fact, very largely sold, and they appear to have given complete satisfaction. The prohibition of salicylic acid—an absolutely necessary step, and one which has been forced on every civilized wine country through the injury to health caused by the drug—has led to the disappearance from the market of nearly all wines which used to be classed as "Sweet delicate," and their substitution by so-called Ports, Madeiras, and Muscats as already described.

Such wines of the bad old salicylic days are only mentioned here, since they prove that it is the sweetness rather than the alcohol of our present-day sweet wines which causes them to be so widely appreciated, and that if wines of similar character, but which do not infringe our pure wine laws, can once more be placed on the market, they will again be favorably received by the wine-drinking public.

SOME EUROPEAN SWEET WINES.

Many sweet wines, of several totally distinct types, are made in the different European wine countries, a lengthy enumeration of which is not here possible, and would only lead to confusion. Those which interest us here, on account of their low alcoholic strength, are made chiefly in France, and, with the exception of Sauternes, which has a world-wide reputation, they are consumed in that country, being but little known outside of it. In this they differ radically from the familiar sweet wines of the Peninsula, grown mainly for exportation.



Village of Sauternes.

Among the sweet wines of France we have, first and foremost, Sauternes, the well-known golden yellow wine, varying, according to vintage, from almost dry to quite sweet. This is held by French connoisseurs to be the king of fruity white wines, a contention which receives strong support from the very high prices the choicest growths are able to command in the world's markets. The methods followed in the growing, making, and maturing of this remarkable wine present so many interesting peculiarities that a brief summary of them will prove of interest.

Sauternes is situated south-east of Bordeaux. As will be seen from the view here reproduced it is quite a small village, but it has given its name to the surrounding district, which, though not a large one, is celebrated for the quality and unique type of the wines grown. A view is also reproduced of Château Yquem, the most celebrated vineyard in

the Sauternes district. The vines from which these wines are made are Semillon and White Sauvignon—about 75 per cent. of the former to 25 per cent. of the latter—the two grapes being blended before fermentation. The wines which have rendered this region famous are, like many of those belonging to the category of unfortified sweet, produced with the help of *Pourriture Noble* (noble rot), the name commonly given in France to *Botrytis Cinerea*, the grey mould which so readily develops on grapes in a rainy autumn. Though this fungus is fatal to the quality of red wines, in which it brings about the disease known as "Casse," it is largely responsible for the extraordinary quality of the white wines of Sauternes and several other choice European districts. In fact, a good vintage is one when mould is very prevalent. The vines are gone over several times, all mouldy grapes being picked first. The *Botrytis* fungus acts in several ways, but mainly by rendering the skin thinner, thus facilitating evaporation and resulting in increased gravity of the must.

"In good years the concentration of the choicest musts may vary from 14 deg. to 30 deg. Beaumé. *Botrytis Cinerea* mainly consumes sugar and acid, but the acid is attacked in greater proportion than the sugar, so that the natural concentration results in the gravity increasing without the acidity exceeding a normal proportion. The action of the mould may be compared to exaggerated ripening. The physiological action also results in the production of several secretions—glycerine in notable quantity, mmeilage, and finally oxidase in abundance, the effects of which on the wine must be combated by energetic sulphuring.

Fermentation of the very rich musts is slow, especially if the autumn be cold, the complete cessation of fermentation only taking place in January or February (July or August in Australia). The first racking is accompanied by a fairly heavy sulphuring to prevent any fresh start of fermentation, which would be detrimental to quality, causing the wine to lose sugar, and tend towards Maderisation.* In the best vineyards the wine is blended to an even standard at the first racking. The wine is racked every three or four months and sulphured each time. With the further aid of several finings, preservation and perfect clarification is secured, rendering the wines fit for bottling, which does not take place until it has spent two or three years in the wood.

Sauternes is soon ready for sale, cask age having given it the necessary qualities. The greater the initial gravity of the must the more does the wine improve with age. If intended for long keeping it must contain enough sulphurous acid, when bottled, to prevent a slow but sure oxidation, which would render the wine brown instead of golden, and develop a rancid taste. Sauternes which has become *Maderisé* is considered to have lost its choicest qualities.†

The following analysis of Château Yquem wines will convey some idea of the type, the leading features of which are low alcoholic strength—remarkably low, in fact, for sweet wine—a variable but considerable percentage of sugar, and a high proportion of sulphurous acid. Sauternes is, in fact, a type of wine the production of which would be impossible without the use of SO₂. Another interesting feature shown is the great preponderance of levulose over dextrose.

* Maderisation is the name given in France to an oxidation phenomenon, akin to "Casse," which results in white wine assuming a more or less brown colour, and taking on a character reminding one of Madeira.

† See Laborde—*Les vins blancs liquoreux*—in *La revue de Viticulture*, 13th February, 1913.

ANALYSES OF CHÂTEAU YQUEM WINES.

Vintage.	1874.	1880.	1889.	1893.	1894.	1896.	1898
Proof Spirit per cent.	26.1	23.5	20.5	22.4	23.8	23.2	24.4
Reducing Sugar (as invert .. sugar)	8.208	2.292	.733	8.27	1.322	6.47	.982
Dextrose	1.938	.698	.232	2.605	.486	1.486	.234
Levulose	6.27	1.594	.501	5.665	.836	4.984	.748
Ash .. .. .	.327	.206	.230	.489	.392	.365	.372
Acid—Total as Tartaric .. ..	.682	1.086	.592	.786	.719	.734	.655
.. Volatile as Acetic .. ..	.54	.12	.13	.12	.93	.11	.11
SO ₂ Free Mgrams per litre	12	25	43	154	110	92	43
Total	179	179	179	604*	330	346	225

See N. Roques *Revue de Viticulture*, Vol. XVI., p. 174.

The Muscats, of which the best known are those of Lunel, Frontignan, and Rivesaltes, deserve special mention. These differ from our Australian Muscats, which are more similar to those of Spain and Portugal, in their greater delicacy, or as those who prefer our Muscats would say, less pronounced character, due to their being made from the white, instead of the brown, variety of muscat. They differ even more from ours in their lower alcohol content, as will be seen from the following analysis of two samples brought from France by the writer in 1908:—

	Muscat de Frontignan.	
	Vintage 1896	Vintage 1897.
Alcohol per cent. proof	26.45	25.75
Total sugar (after inversion) per cent.	2.54	2.16
Sugar free extract .. .. .	.36	.18
Ash	0.28	.024
Sulphates (as K ₂ SO ₄) Grams. per litre	1.43	1.55
SO ₂ Mgrams. per litre total	35	25
.. free	3	3
Acidity (Total (as tartaric) per cent.	0.36	0.34
.. Volatile (as acetic)	0.05	0.04

Examination for prohibited preservatives and sweetening substances gave negative results.

In spite of their moderate spirit strength and far from high SO₂ content, these wines stood the voyage perfectly, arriving in excellent condition, which they retained during the year they were kept under observation. French muscats are made from over-ripe grapes; they are fermented slowly in small volumes at low temperature. Such conditions differ widely from those under which our wine-makers are compelled to work in Northern Victoria. The method followed, though interesting, would need much modification to meet our requirements.

* It is noteworthy that this wine contains more total SO₂ than is permitted by French law. The samples of '94, '96, and '98 wines, though complying with the French law, contain more SO₂ than Victorian legislation permits.

A very interesting type of light, sweet wine is that to which belong *Clairette de Die* and *Blanquette de Limoux*, wines held in high esteem in the neighbourhood of the localities where they are produced. These wines, which are chiefly intended for local sale, are distinctly sweet; they contain relatively little alcohol, and are more or less sparkling. This last characteristic is not a necessary one, and the method which permits the retention of sweetness may equally well be applied to dry wines. In brief, it consists in the carrying out during fermentation of several skimmings and filtrations, so as to remove as much yeast as possible. The aeration accompanying each filtration stimulates the growth of a fresh crop of yeast, which is again removed by a fresh filtration. Such exaggerated but futile yeast production impoverishes the must until a stage is reached when fermentation can no longer continue. So efficient is the method that it permits of the making of wines retaining 2 to 3 per cent. of sugar, and over, which remain in perfect condition at an alcoholic strength of about 15 per cent. proof, and even less. The process is, in fact, similar to that which permits the retention of sweetness in cider, of even lower alcoholic strength.

Another sweet wine which belongs to this class is the celebrated Tokaj or Tokay, grown on the slopes of the Hegyalja hills, south of the Carpathians, in Hungary, which undoubtedly ranks as one of the very choicest sweet wines. Though of moderate alcoholic strength (usually from 2½ to 26 per cent. proof), it differs mainly from Sautesnes, in that SO₂ is very sparingly used in its making—a fact which is evidenced by its deeper colour (Tokay is brown, whilst Sautesnes is golden).

There are several varieties of Tokay, differing considerably in strength and sweetness, but possessing the common property of remarkable fragrance; they vary from slightly fruity to extraordinarily sweet.*

The process followed in the making of these remarkable wines is somewhat complicated; it is mainly based on over-maturity, a considerable proportion, and, indeed, sometimes the whole, of the grapes being quite shrivelled, or *Aszu*, as it is termed in Hungarian, before being vintaged. Fermentation is conducted very slowly, at a low temperature.

* J. Laborde, in an article on Tokay (see *Revue de Viticulture*, 31st July, 1913) gives analyses of five distinct types. The following extracts will give some idea of the great variability in composition. The types represented are the following:—

- No. 1. Ordinary table wine of Tokay-Hegyalja; made without shrivelled grapes. Tarcal, vintage 1901.
 No. 2. *Szemorodni*, made from slightly shrivelled grapes, but only slightly sweet—less so than the following. Szekespatok, vintage 1901.
 No. 3. *Aszu*, five tubs. The number of tubs indicates the proportion of shrivelled, or *Aszu*, grapes which has been added to a hoghead of must, and consequently, the degree of sweetness. Tarcal, vintage 1901.
 No. 4. *Aszu*, four tubs. Tallya, vintage 1890.
 No. 5. *Essence*, or wine made entirely from shrivelled grapes. Tolecsa, vintage 1901.

	I.	II.	III.	IV.	V.
Alcohol	25.2	23.9	21.4	23.0	12.5
Total acidity	0.76	0.94	0.96	0.62	1.29
Volatile acidity	0.13	0.10	0.15	0.13	0.21
Extract	3.16	7.73	18.74	9.26	33.73
Reducing substances (sugar)	0.29	2.6	13.4	5.75	25.77
Dextrose	0.16	1.82	6.95	2.88	13.9
Glycérine (natural)	0.03	0.03	6.45	2.77	11.57
Tannin	1.08	1.43	1.8	..	1.45
Polariscope deviation	0.02	0.015	0.03	..	0.024
	-0°14	-1°38	-3°15	-1°30	-7°14

No. V., with nearly 26 per cent. of sugar, is almost a syrup, yet its low alcohol strength of 12½ per cent. proof suffices to keep it sound, and this without SO₂. Tokay, it is needless to state, contains no other preservative.

We cannot here examine the process in detail, nor would it be very profitable to do so, seeing the great difference between Australian conditions and those which prevail in Hungary.

Many other sweet wines might be cited—the Italian Asti, somewhat similar to *Clairette de Die*; the *Rancios*, of Banyuls and Collioure, in the French Pyrenees, and numerous others, but the types mentioned above will suffice.

THEORETICAL ASPECT.

Sweet wines are made by withholding from fermentation a portion of the natural sugar of the must. This may be achieved in various ways, the addition of an antiseptic being the most convenient. In the case of fortified wines, alcohol itself is the antiseptic employed. Supplementing the natural strength by artificial addition—in other words, fortification to 18 to 20 per cent. by volume (32 to 35 per cent. proof), at which strength yeast action is no longer possible—is the method by



Chateau Yquem.

which Port and other kindred wines are made. We have seen how salicylic acid was used for the same purpose until its further use was prohibited. Any other tasteless antiseptic would serve equally well, were it not that all antiseptics, with the single exception of sulphurous acid (SO_2), have properly been banished from the wine cellar by pure food legislation. Even this agent, which has been employed in wine-making since the time of ancient Rome, is now subject to rigorous control; nevertheless we have, in its judicious use within legal limits, a means of sweet-wine production which has rendered possible the evolution of Santernes and several other wines.

The same object may be attained by other means—over-maturity, for instance. Grape sugar, or, as it is usually termed, glucose, is in reality a mixture of two very similar sugars; they are identical in percentage chemical composition, as is shown by their common empirical formula, $\text{C}_6\text{H}_{12}\text{O}_6$, but differ in their physical properties. Examined

in the polariscope, a solution of one of these deflects the polarized ray to the right, whilst in the case of the other it is turned to the left; hence the terms dextrose and levulose, by which they are respectively known. They are also differently acted upon by yeast. It is true that different yeast organisms show some variability in this respect, but, in a general way, dextrose undergoes alcoholic fermentation much more readily than levulose. In the juice of grapes which have just reached maturity the proportion of each sugar is about equal, but in that of over-ripe grapes levulose is the more plentiful. Hence it is that the juice of over-ripe grapes is more difficult to ferment completely than that of grapes which are just ripe, and no more. Practically all unfortified sweet wines are made from over-ripe grapes, notably Tokay, French Muscats, and Sauternes. More particularly in the case of those where concentration is carried furthest, as, for example, in Tokay "Essence," it is remarkable how the wine maintains its condition at a low alcohol strength, and this without sulphuring, such as is characteristic of Sauternes. Sugar itself, especially with the help of a little alcohol, seems to act as an antiseptic, once a certain stage of concentration is reached—much in the same way that jams are protected from further change by the use of sugar alone. In all such wines, where the aid of SO_2 is not had recourse to, slow fermentation at low temperature is absolutely essential to success.

Then we have what may be termed the "yeast starvation" method employed in the case of *Clairette de Die* and some other wines. In a previous article* recommending the use of Ammonium Phosphate as a yeast stimulant in sluggish fermentations when a dry wine is the objective, it was pointed out how yeast, in aerobic development—in other words, growing in presence of much air—reproduces itself much more abundantly, but possesses less fermental power than the same yeast in the absence of air, or in anaerobic life. The larger crop of yeast naturally makes greater demands on the stock of assimilable nitrogen and phosphoric acid in the fermenting medium—elements which are not abundant in grape juice. The case now under review is the exact opposite of the one previously considered, but the same principle applies, the very yeast starvation which often hinders the production of a dry wine being turned to useful account in the making of a light, sweet wine. The yeast starvation is brought about by the removal of nitrogen and phosphoric acid, the yeast itself being the agent employed to effect such removal. Though *Clairette de Die* and *Blanquette de Limoux* have been made for centuries, the scientific principles underlying their manufacture were first explained in a report to the Agricultural Society of the Drome Department (France) by MM. L. Roos and J. Rolland, in 1902.

We have thus three quite distinct principles, the practical application of which will enable us to make unfortified sweet wine. These are:—

- (a) Over-maturity of the grapes (fermentation at low temperature being absolutely essential).
- (b) Yeast starvation.
- (c) Addition of SO_2 .

* See Journal of the Department of Agriculture, April, 1909.

In practice, one alone of these is rarely depended on; it is a combination of two, or even of the whole three, which is more usual. Nevertheless, one of these principles generally overshadows the others in the making of any particular sweet wine. Tokay is almost entirely based on the first, Clairette de Die on the second, and Sauternes on the third.

PRACTICAL HINTS.

Under the climatic conditions which prevail during vintage in Northern Victoria, a combination of the three above-mentioned principles is strongly recommended. The grapes intended for unfortified sweet wine should not be vintaged until over-ripe;* yeast starvation is then brought about by filtering, followed by aeration, and further fermentation prevented and permanent condition secured by the addition of SO_2 . It is, no doubt, possible to dispense with filtration and preserve sweetness by the use of SO_2 alone, but the quantity required would be much more considerable; hence the advisability of combining the three methods.

The gravity of the must should be at least 16 deg. Beaumé; satisfactory results will not be obtained so easily below this. Very complete yeast starvation brought about by repeated filtration will, however, permit of sweet wines being made from musts of lower gravity.

Fermentation should be carried out in small bulk, preferably in hogsheads, and temperature must be carefully controlled, 75 deg. F. being the limit which cannot safely be exceeded. If too active it may be checked by adding bisulphite of potash, a record being kept of each addition, with a view to guarding against the legal limit being exceeded.

As regards yeast starvation: Though frequent skimming can remove a good deal of yeast, filtration is far more effectual. A pulp filter is to be preferred. The object being only to remove the greater part of the yeast, complete clarification is not necessary; hence the pulp need not be packed very tightly. This is fortunate, as, owing to its viscosity and the presence of bubbles of CO_2 , fermenting must passes slowly through the filter. Filtration must be followed by aeration to stimulate fresh yeast growth; a bicycle foot pump, attached by a rubber tube to a block tin or gun-metal pipe, is very convenient for the purpose. Two to three aerations at six to eight hours' interval should suffice. The number of filtrations cannot be absolutely fixed. Experimentation in each locality can alone decide. In a general way, two filtrations will usually lead to such a reduction in the activity of fermentation that a small addition of bisulphite will cause it to cease altogether.

The first filtration should not be carried out too soon—not until there has been considerable yeast production. Prior to this it may be advisable to aerate, but as a rule fermentation will be sufficiently active without it. In the case of a must with an original gravity of 16 deg. Beaumé, the first filtration may be given when this has fallen to 11 deg. or 12 deg., and the second when it stands at 5 deg. or 6 deg. Here, again, the figures cannot be rigorously fixed; the treatment will depend on the rate of fermentation and the degree of sweetness desired.

* In seasons when grapes will not become sufficiently over-ripe if left hanging on the vine, partial drying, on *calish* trays in the sun, for a couple of days, may be resorted to. This procedure is usual in Jerez (Spain), where grapes are exposed on esparto mats in the *almijar* (an open courtyard).

The dose of SO_2 and the best time to apply it also vary; they are chiefly governed by the amount of filtration which has been practised. The more frequent and thorough this has been, the less SO_2 will be needed. If filtration is dispensed with, heavy doses will be necessary; probably to near the limit allowed by law. This limit, according to our Wine Adulteration Act, is 20 centigrammes of total SO_2 per litre—in other words, a shade over $3\frac{1}{2}$ oz. per 100 gallons, a quantity which would be contained in 7 oz. of good commercial bisulphite of potash (50 per cent. of SO_2). These figures will give an idea as to the quantity which may be safely used and the total which must not be exceeded. It must be remembered that a heavily-sulphited wine is not immediately marketable, since it would exceed the limit allowed for free SO_2 (one-tenth of the allowance of total SO_2) until the bulk of it has gone into the combined state—a change which will have come about within a few months after addition.*

It must be remembered that the object in view being actually the reverse of a dry wine, the procedure must be radically different from sulphiting in the ordinary way. In that connexion the addition of the whole dose of SO_2 before the start of fermentation was strongly recommended. In the case of sweet wines, on the contrary, such early additions would be most ill-advised. SO_2 should be added progressively as fermentation proceeds, in small quantities at a time, as may prove necessary to moderate and control it.

The type of wine which it is desired to make must be considered. If this is to be of fairly deep colour, with Rancio or Madeira character, yeast starvation must be mainly resorted to, and SO_2 used sparingly, if at all. If, on the other hand, a golden colour and more delicate character is preferred, then SO_2 must be freely used.

CONCLUSION.

It must not be imagined that by the above, or, in fact, any treatment, common must can be converted into anything even distantly resembling some of the very high-grade wines mentioned above. Such wines as Sauternes and Tokay are inimitable; they owe their wonderful quality to a fortunate combination of natural circumstances, and science has proved powerless to grow anything similar outside of the vineyards privileged by Nature to produce them. The aim of the present article is something much more modest, though it is something which has not been extensively attempted in Australia as yet. The writer is hopeful that, by the application of the methods outlined above, the object proposed at the outset can be satisfactorily achieved, namely, the production of sound, wholesome sweet wines of moderate alcoholic strength, such as are sure to meet with a ready demand on our local market, and of which larger quantities could safely be consumed than of the present type of fortified sweet wine. Experiments conducted within the past few years leave no doubt as to the feasibility of the making of such wine on a large scale and under Victorian climatic conditions.

* Even after a few months, however, the whole of the added SO_2 will not be present as "Total" i.e., free and combined, for the reason that part of it has come oxidised to sulphuric acid. This will be found in the form of sulphate of Potash. It is quite safe to use SO_2 right up to the legal limit, provided the addition is made a sufficient time before the wine is offered for sale.

SOME USEFUL HINTS ABOUT MILKING THE COW.

By R. R. Kerr, Dairy Supervisor.

In the minds of most people, including many dairymen, very little thought or attention is given to the milking of a cow. Many of the failures at dairying are due to a lack of knowledge of this important subject, and when that is missing, the cows soon feel and show the results. They gradually go dry, and, with poor returns, dairying is branded an unprofitable industry, and the cows as duffers. What constitutes a good milker, or by what method a man can get the utmost from a cow—leaving out the question of feed—is a matter too often neglected. I regret to state that the milking of cows on many dairy farms seems to be a secondary consideration, the apparent object being to get the cows out of the yard as soon as possible. Now, while it is necessary that cows should be milked quickly, they must not be rushed through.

A large majority of our best cows are of a sensitive nature, and not at all suited to the methods of learners. The old idea that any one could milk a cow is all moonshine, as some milkers can get far better results than others. Many experiments have proved this, and it is common knowledge with our experienced and successful dairyman; consequently it pays to give the right man a higher salary. In nearly all the older dairying countries of the world, most of the milking is done by the women folk, who possess inherently gentle methods of handling animals—one of the most important items in successful dairy farming. There seems to be some prejudice against girls doing dairy work, but, to my mind, when the conditions are sanitary and comfortable, they would be far better off in the open air and sunshine than in many of the occupations now sought by them. Where there is specialization in dairying, and the individuality of the animals is studied, the drudgery is removed, and the dairy cow becomes an interesting study and worth far more consideration and care than is generally given her. Many of our best cows produce over ten times their own weight of the most digestible food, and leave progeny to do likewise. No other farm animal does so much. The racehorse is given every care and preparation for the chance of winning a race; surely the good cow is worthy of the like consideration, so that her years of usefulness may be prolonged. A common question, asked by many dairymen when employing a milker, is, "How many cows can you milk in an hour?" Many exaggerated answers are given. The steady, reliable milker is worth all the cracks, and if a man averages eight or nine cows an hour in the spring months he is not losing much time, although odd men can do more.

The old question, wet versus dry milking, is a perennial topic, and much could be written on the subject. Bacteriological examinations have proved that dry milking is more cleanly, but where the cow's udders are well wiped, and the milker's hands regularly washed, some advantage can be claimed for the wet method, which is the more common in the State, although the hands should be moist—not actually wet, and moist teats are an aid to a milker in stripping a cow. Wet milking without the washing of the udders and the milker's hands is a filthy practice. It is well known that the last milk drawn from the udder is

much richer in fat than that taken at first. This is one of the reasons why the milker should secure all the milk, but the most important is that it encourages the cow to produce more milk. In their natural state cows produce just sufficient milk to nourish their young; they soon find out their requirements, but domestication has achieved a wonderful change, and the cow is now much like a machine. For generations the young animal at birth has been removed, and all the milk the cow could produce taken. These practices give us the wonderful dairy cows of to-day. If cows are not milked dry they soon become accustomed to such treatment, and keep on decreasing their yield until ultimately they cease to yield at all. Learners never should be allowed to milk good, full milk cows; it is much better to let them practice on the strippers, or some cow of little value, as their methods soon upset a good cow. Weak-wristed persons do not make good milkers, as most cows need a good, strong milker, with his full hand. Thumb and finger milking should be avoided whenever possible; the proper method is to squeeze the teat and slightly pull it. Many young heifers have their teats ruined by unnecessary dragging with the thumb and finger; it injures the inside of the teat, causing what is commonly called a pea in the teat. The young heifer needs very gentle pressure: if too forceable methods are employed, she becomes frightened and starts to kick, and then one can be sure that the best results are not being obtained; her teats are sensible to pain, and the milking hurts her. Take plenty of time to milk such a cow, and see that the finger nails are cut close. When she is first bailed or penned, let her stand a time, to get accustomed to her surroundings. Any ill-treatment at this stage will in most cases ruin her for all time.

Very few cows can be completely finished by milking with the full hand, and when the main flow has ceased; to strip the cow, it becomes necessary to gently press a quarter with one hand, and milk with the other, thus drawing the udder.

A cow, once started, should be always finished without interruption: the milker's mind must be centred on his work to gain the sympathy of the animal; dilatory or slow milking, talking and noise-making should be avoided—such actions cause a decreased flow. Where milking machines are used, the cows should be first tried for udder troubles and stripped immediately the machines are removed; any time elapsing between generally results in the cow holding back the last and richest of her milk. This is the cause of many of the complaints about milking machines being unsatisfactory, as the cow soon becomes dry—really the fault of the operator. If an animal does not let her milk down freely to the machine, do not persist in its use, as such persistency will surely cause her to go dry. It is much better to milk such a cow by hand, or any other whose udder conformation does not lend itself to easy milking: very large teats with a hard skin are unsuitable. Best results may be obtained from cows with low hanging udders by the attendants using a very low stool and keeping the arms on a level with the teats.

Approach the cows gently. It is desirable that the usual attendant attach the teat cups on the first occasion. The cow is governed by habit, and most cows dread a new milker. In cold weather, provide warm water to insert the teat cups in, and wash the udders.

While the milking machine, in the care of an intelligent man, may solve the labour problem, it will do endless damage in the hands of a careless operator. The cleanest and purest milk can be obtained by machines, if properly handled. Do not wash the udders too far in advance of the machine, as the cow will have taken her milk up again; she should be milked immediately after the washing and drying, when her teats will be full of milk; then the machine will do its work more effectively and quickly.

One hears much about the near and off side of a cow or the milking side. We milk cows on both sides, and the proper term to use is the right or left side. When a cow has a weak quarter, milk that teat first, to encourage more milk to come into it; a good rubbing is also beneficial. One should at all times endeavour to keep the cow's udder well balanced; this can be accomplished or maintained by partially milking the two fore teats, then likewise the rear teats, then completing the milking at the next exchange. If an animal suffers from sore teats, endeavour to get the sore in the palm of your hand. Sore-teated cows stand more easily to machine milking. Better results will be obtained if sick and injured cows are always milked by the same milker. Tough cows are more easily milked by putting nearly all the pressure near the point of the teat, but animals of this class seldom pay to keep, unless they are exceptionally good. The insertion of any instrument into the teat generally ends by the cow losing the quarter, despite all care. The dairyman must understand the different individuals in the herd and humour them to get the best results; it is no use trying to force a cow against her will. Some cows will not give their milk if allowed to remain too long in the stalls; others, again, only give their milk freely to particular attendants. One fault of feeding cows during milking is that the animals often get the habit of only giving their milk when feeding; it is much better to feed them before milking, although a very nervous animal will do better if fed during the milking; she generally stands quieter. Never feed strong-smelling foods just prior to milking, as they are apt to taint the milk. Strangers in the shed during milking hours often upset the cows. Any handling of the animals should be done after the milking.

Many of the dairymen are greatly troubled in the spring months by the low butter fat tests of their herds; while admitting that poor feeding cows are the greatest cause, the period between the milkings is often a considerable factor in reducing the percentage of fat of any particular milking. The shorter the period between the milkings, the richer the milk; this is found in the evening's milk, which is nearly always the richer, as less time elapses between the morning's and evening's milkings than between the night's and morning's. It is the morning's milk that has the low fat percentage; the cow then has her greatest flow of milk. Taking an average, the cows would have fifteen hours' milk in the morning, and nine in the evening; in some instances greater variations occur. When the periods are more evenly distributed the tests are more uniform and the cows do not suffer from distended udders, or overstacking, as it is generally termed. This, besides being cruel, often results in injured udders. All cows suffering from sickness should be milked last, or, better still, isolated, as this reduces the danger

of infection and gives more time to attend to their wants. Injured and sore-teated cows should be treated in the same manner. Any man is very foolish to rush his cows about or ill-treat them in any way. While dogs may be all right in some cases, when properly handled, they are much better away from milking cows, who are ever in constant fear of them. The placing of a large number of cows in a small yard is often another source of trouble; they generally horn one another and inflict serious injuries. That is where polled cows come in—they stand much quieter and cannot hurt each other. Remember always that any bad treatment of the dairy cow has an immediate effect on the milk flow.

Have a water trough in the cow yard. Bring the animals in later in the evenings during the hot weather; they will be more contented. Keep them warm in winter; they are more easily milked, and it benefits the animal and economises feed.

Cows should be dried off gradually. When they are hand-fed, the feed can be regulated in most cases to accomplish this, but when cows are on good pasture it is much harder, and many good ones milk right through to the next calving—to force them dry would be to ruin their udders. Let them be milked once a day for a start, then every day or so, not necessarily milking them dry. When it is apparent that a cow will not go dry before recalving, feed her the most nourishing food, to help rebuild the cell system of the udder. When the animals are in good condition they do not need a long spell, about six weeks being sufficient, but if low in condition, much longer will be needed. No spell means a decreased production the following lactation period. It is penny wise and pound foolish to allow the dry cows to lose condition; it not only weakens their constitutions and makes them more susceptible to disease, but it also weakens the unborn calf, which might be your future dairy cow.

One point remains to be mentioned, and it is an important one. Many men over-confident in their knowledge pass poor judgment on animals that do not conform to their ideals. While they might pick out the best-looking animal, they do not choose the most profitable with any surety. These profitable cows are included in all breeds, within no strictly defined lines, and are only discovered by the recording of the milk yields and the percentage of butter fat contained therein.

The observations mentioned herein have been gained by a long experience amongst dairy animals, and while the opinions expressed may not be infallible, they are mostly based upon actual fact, and contain some hints that will be useful to any beginner in dairy farming.

CORRECTION.

Wheat Exhibits, Royal Agricultural Society's Show.

In the December issue of this *Journal* it was wrongly stated that the second prize for the low-strength wheat section was awarded to J. B. Schulze, of Dimboola, with a sample of King's Early. The second prize was won by P. Handreck, Mountajup, with an exhibit of Yandilla King.—*Editor.*

STANDARD TEST COWS.

REPORT FOR QUARTER ENDING 31ST DECEMBER, 1914.

Of the total cows completing their terms during the currency of the quarter under review, 25 qualified for certificates.

One new herd (Jersey), that of Mr. C. E. Wood, Frankston, entered during the period.

It is noteworthy that last season's record of 585½ lbs. butter-fat, which was put up by Mr. Brisbane's Scottish Queen of Gowrie Park, has now been exceeded by the same owner's Ida of Gowrie Park—last year's runner-up. Individual returns are as follow:—

Mrs. B. M. BECKWITH, Malvern. (Dexter Kerry).

Completed since last report, 1. Certified, 1.

Name of Cow.	Herd Book No.	Date of Calving.	Date of Entry to Test.	No. of Days in Test.	Weight of Milk last Day of Test.	Weight of Milk.	Average Test.	Butter Fat.	Standard required.	Estimated Weight of Butter.
Kilow	Not yet allotted	5.2.14	12.2.14	273	lbs. 16½	5,658	4.62	lbs. 261.64	lbs. 250	lbs. 298½

W. P. BRISBANE, Weerite. (Ayrshire).

Completed since last report, 1. Certified, 1.

Name of Cow.	Herd Book No.	Date of Calving.	Date of Entry to Test.	No. of Days in Test.	Weight of Milk last Day of Test.	Weight of Milk.	Average Test.	Butter Fat.	Standard required.	Estimated Weight of Butter.
Ida of Gowrie Park	2,422	14.3.14	21.3.14	273	lbs. 26½	11,917½	5.08	lbs. 605.05	lbs. 250	lbs. 689½

DEPARTMENT OF AGRICULTURE, Werribee. (Red Polls).

Completed since last report, 1. Certified, 1.

Name of Cow.	Herd Book No.	Date of Calving.	Date of Entry to Test.	No. of Days in Test.	Weight of Milk last Day of Test.	Weight of Milk.	Average Test.	Butter Fat.	Standard required.	Estimated Weight of Butter.
Samoona	Not yet allotted	20.2.14	5.3.14	273	lbs. 14	4,397½	4.82	lbs. 212.07	lbs. 175	lbs. 241½

GEE LONG HARBOR TRUST, Marshalltown. (Ayrshire).

Completed since last report, 7. Certificated, 2.

Name of Cow.	Herd Book No.	Date of Calving.	Date of Entry to Test.	No. of Days in Test.	Weight of Milk last Day of Test.	Weight of Milk.	Average Test.	Butter Fat.	Standard required.	Estimated Weight of Butter.
Gipsy Maid of Sparrovale	2,510	13.1.14	20.1.14	273	lbs. 7½	lbs. 4,411½	4.32	lbs. 190.63	lbs. 175	lbs. 217½
Sweet Flower of Glen Elgin	1,844	5.3.14	12.3.14	220	4	5,681	4.61	261.71	250	298½

A. W. JONES, St. Albans. (Jersey).

Completed since last report, 1. Certificated, 1.

Name of Cow.	Herd Book No.	Date of Calving.	Date of Entry to Test.	No. of Days in Test.	Weight of Milk last Day of Test.	Weight of Milk.	Average Test.	Butter Fat.	Standard required.	Estimated Weight of Butter.
Lady Gray IV.	Not yet allotted	7.2.14	14.2.14	273	lbs. 19	lbs. 7,250½	5.76	lbs. 417.78	lbs. 450	lbs. 476½

C. G. KNIGHT, Cobram. (Jersey).

Completed since last report, 3. Certificated, 2.

Name of Cow.	Herd Book No.	Date of Calving.	Date of Entry to Test.	No. of Days in Test.	Weight of Milk last Day of Test.	Weight of Milk.	Average Test.	Butter Fat.	Standard required.	Estimated Weight of Butter.
Miss Twylsh	2,360	24.1.14	31.1.14	231	lbs. 14½	lbs. 3,881½	5.46	lbs. 250.73	lbs. 200	lbs. 285½
Mistletoe	2,384	4.2.14	11.2.14	273	17½	5,888½	5.01	205.09	175	336½

* 8-11 42 days before term expired.

C. D. LLOYD, Caulfield. (Jersey).

Completed since last report, 1. Certificated, 1.

Name of Cow.	Herd Book No.	Date of Calving.	Date of Entry to Test.	No. of Days in Test.	Weight of Milk last Day of Test.	Weight of Milk.	Average Test.	Butter Fat.	Standard required.	Estimated Weight of Butter.
Doreen	2,976	18.3.14	25.3.14	273	lbs. 13½	lbs. 4,952½	5.38	lbs. 266.26	lbs. 175	lbs. 309½

C. GORDON LYON, Heidelberg. (Jersey).

Completed since last report, 6. Certified, 6.

Name of Cow.	Herd Book No.	Date of Calving.	Date of Entry to Test.	No. of Days in Test.	Weight of Milk last Day of Test.	Weight of Milk.	Average Test.	Butter Fat.	Standard required.	Estimated Weight of Butter.
Silvermine V.	1386	27.12.13	3.1.14	273	184	5,515	5.12	282.40	250	322
Silver Pride	1387	20.12.13	5.1.14	273	181	6,097	4.70	286.53	200	326
Silver Audrey	1378	30.12.13	6.1.14	273	154	6,128	4.98	305.08	200	348
Silvermine III.	715	6.1.14	16.1.14	273	204	7,266	5.16	426.31	250	490
Hawthorn	1,004	4.3.14	11.3.14	273	21	7,585	5.16	391.55	250	440
Hawthorn II.	Not yet allotted	6.3.14	13.3.14	273	2	4,205	5.35	225.10	175	256

* Sickness for seven days affected yield.

SADLER BROS., Noorat. (Ayrshire).

Completed since last report, 3. Certified, 2.

Name of Cow.	Herd Book No.	Date of Calving.	Date of Entry to Test.	No. of Days in Test.	Weight of Milk last Day of Test.	Weight of Milk.	Average Test.	Butter Fat.	Standard required.	Estimated Weight of Butter.
Louise of Ereh-foban	2,692	20.3.14	27.3.14	273	124	5,721	4.11	245.46	175	267
Glady's of Ereh-foban	Not yet allotted	20.3.14	2.4.14	273	4	7,473	3.91	292.31	250	333

W. WOODMASON, Malvern. (Jersey).

Completed since last report, 9. Certified, 8.

Name of Cow.	Herd Book No.	Date of Calving.	Date of Entry to Test.	No. of Days in Test.	Weight of Milk last Day of Test.	Weight of Milk.	Average Test.	Butter Fat.	Standard required.	Estimated Weight of Butter.
Laura VIII. of Malrose	Not yet allotted	3.12.13	7.1.14	273	191	4,734	5.50	260.42	175	296
Louise V. of Malrose	1,406	8.1.14	15.1.14	273	19	5,284	6.01	366.60	250	418
Betty V.	Not yet allotted	23.1.14	30.1.14	273	21	5,200	5.77	415.51	250	473
Melrose VIII. of Malrose	Not yet allotted	21.1.14	31.1.14	273	181	5,536	6.32	351.02	250	400
Louise VI. of Malrose	Not yet allotted	20.2.14	27.2.14	273	20	7,667	5.68	435.78	250	496
Jenny III. of Malrose	Not yet allotted	1.3.14	11.3.14	268	171	7,081	5.03	356.39	250	406
Jessie of Malrose XIV.	Not yet allotted	16.3.14	21.3.14	273	19	4,411	5.51	228.34	175	201
Lady Malrose III.	Not yet allotted	16.3.14	23.3.14	273	18	5,152	5.22	260.22	175	307

* Last five days through omission to weigh.

F. J. STANSMORE, Pomborneit. (Ayrshire).

Completed since last report, 29. Certified, 1.

Name of Cow.	Herd Book No.	Date of Calving.	Date of Entry to Test.	No. of Days in Test.	Weight of Milk last Day of Test.	Weight of Milk.	Average Test.	Butter Fat.	Standard required.	Estimated Weight of Butter.
					Lbs.	Lbs.		Lbs.	Lbs.	Lbs.
Ida of Yalart ..	2,717	5.1.14	12.1.14	273	17	5,937½	4.97	295.20	250	336½

PRICKLY PEAR FOR DAIRY COWS.

The prickly pear is denounced as Australia's greatest pest in your issue of 2nd April, page 767. If the species found there is anything like the American prickly pear, perhaps the result of a test by the Dairy Division of the Bureau of Animal Industry may be of interest.

Prickly pear is very palatable to dairy cows, and when fed in amounts varying from 60 to 100 lbs. a day makes the cow very thrifty and productive. Larger amounts are too laxative in effect. The pear is low in protein and high in mineral matter. It contains from 87 to 93 per cent. of water, and hence is a capital supplement for cotton seed and its products. Compared for milk-making with other southern roughages, 1 lb. of sorghum hay equals 10.1 lbs. of pear, 1 lb. of sorghum silage equals 3.3 lbs. of pear, and 1 lb. of cotton seed hulls equals 8.8 lbs. of pear. By substituting 60 to 75 lbs. of pear for a portion of dry roughage, the per cent. of fat in the milk dropped .42 per cent. on the average, but the milk flow increased.

Two dry cows were maintained for fifty and sixty days respectively on 113 and 105 lbs. of pear and 2 lbs. of cotton seed meal daily. One cow fed pear alone lost 30 lbs. in weight in seventy days. Another cow died from stoppage of the intestine by fibre balls from the pear when it was the sole ration. Pear-fed cows were more sensitive to the cold, and lost about 7.5 per cent. in milk flow when fed a heavy pear ration, as compared to 1.91 per cent. for cows on a dry ration. Cows fed pear drank less water, those receiving no roughage except pear going for days at a time without drinking. This shows pear to be a valuable feed when there is a scarcity of water.

One man can singe a ton of pear in fifty minutes with a gasoline torch, using 1½ gallons of gasoline. The pear is singed on the stalk, and may then be pastured, which is wasteful, or cut and fed. The spineless pear is about the same in composition, may be harvested more cheaply, but yields less product. It costs about 6 dol. to 7 dol. per acre to establish a field. Shallow cultivation for weeds and grass is necessary. The second year's yield in Texas was 85 tons per acre, while the yield from old stumps runs above 100 tons per acre.

Department of Agriculture,
Queensland.

E. W. MORSE.

—*Breeders' Gazette*, 25th June, 1914.

IRRIGATED LUCERNE AT CENTRAL RESEARCH FARM, WERRIBEE.

Preliminary Results of Tests.

A. E. V. Richardson, M.A., B.Sc. (Agric.), Agricultural Superintendent.

Every cultivated plant, be it cereal, forage, legume, or fruit, has somewhere its enthusiasts and devotees, who are ever ready to extol the merits and value of their favourite crop. Lucerne is no exception to the rule, and enthusiastic growers of this legume have variously dubbed it "The king of fodders," "The greatest mortgage-lifter yet discovered," "The best soil renovator known to agriculture."

Whilst such praises may seem extravagant to the lay mind, yet it must be admitted that, given suitable soil conditions, lucerne is one of the most prolific and nutritive forages that can be grown on the farm.

Certainly it must receive large quantities of moisture during the growing period to reach perfection, consequently full and profitable growth may only be looked for either where (1) the summer rains are abundant, (2) irrigation is practised, or (3) where supplies of underground water are available at reasonable depth.

This, perhaps, might be expected, for no plant can accumulate large quantities of nutritive matter in its stem and leaves without transpiring considerable quantities of water, and the tests so far carried out at Werribee seem to show that successful lucerne growing depends more on keeping the soil and subsoil at a proper degree of moisture saturation by judicious irrigation than on fertilizing, inoculating, liming, cultivating, or manuring the soil.

This will be apparent when the preliminary results of the lucerne tests at the Central Research Farm, Werribee, are considered. The various results obtained, however, are not by any means to be considered final. Tests with a perennial forage like lucerne must be carried out for a number of years in succession on systematic lines before deductions of value may be drawn. It is intended to briefly describe the experiments in progress, and to indicate some of the more important results obtained.

I. Preparation of the Land.

PREPARATION OF THE LAND FOR LUCERNE.

Before discussing details of the various trials, a short account of the mode of treatment of the land and the crop will be an advantage.

The 50-acre block on which the tests were carried out is similar in character to the average irrigation land on the Werribee Estate. The soil is a reddish clay loam, varying in depth from 7 inches to 9 inches, and resting on a more or less impermeable, stiff, red clay subsoil. The Werribee soils closely resemble the red clay loams of the Goulburn Valley, both in chemical composition and mechanical texture, except that they appear slightly deeper and rather more permeable to water. Compared, however, with the friable, free-working, well-drained loams of some of the northern settlements, *e.g.*, Cohuna and Merbein, the permeability of the Werribee land leaves much to be desired. Moreover, a portion of the land is quite as tenacious and sets as hard as the inferior class of Goulburn Valley land.

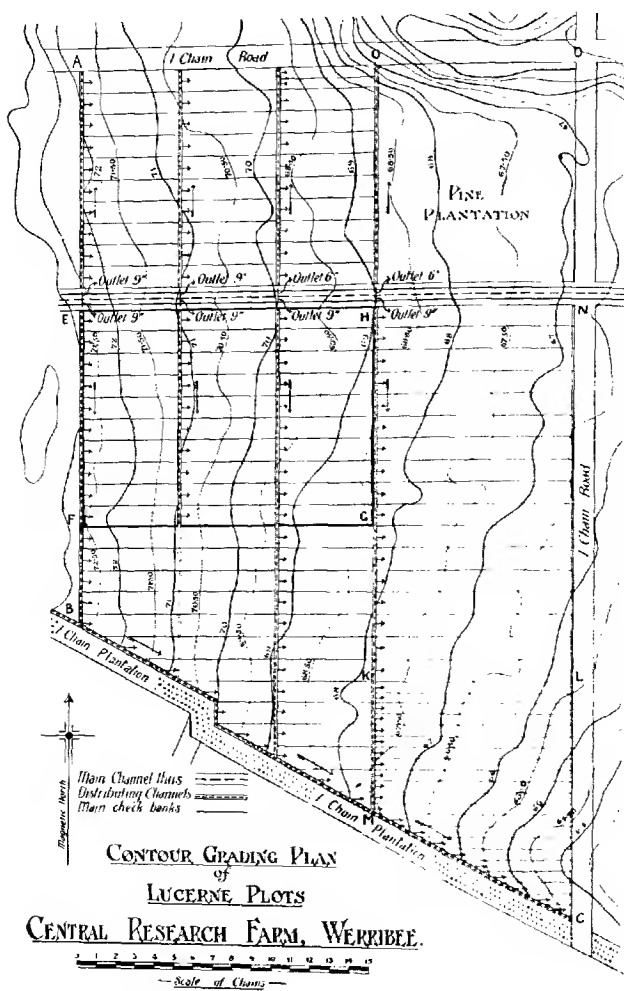


Fig. 1.

SUBSOILING.

It was felt, therefore, that good growth of lucerne could only on such soil result from some form of cultivation which opened up the subsoil and permitted free development of the root system of the lucerne.

Consequently, the whole of the area was cultivated to a depth of 12 inches to 14 inches by means of suitable subsoilers. For this purpose a specially constructed subsoil plough was used. This consisted of a double-furrow Mitchell plough, in which the front mould-board was replaced by two strong curved steel tines working 6 inches to 8 inches below the level of the remaining mould-board, which turned over the sod to a depth of 6 inches to 8 inches, according to the depth of soil available. The curved tines opened up the soil to a depth of 12 inches to 14 inches, *i.e.*, the subsoil was deep-stirred to a depth of 6 inches to 8 inches below the furrow slice without bringing any of the raw, crnde subsoil to the top.

As the fall of the land was such as to necessitate a system of checks and cross checks at a distance of 1 chain apart, the subsoiling was done in 1-chain lands at right angles to the line of fall, and the crowns of the lands were subsequently utilized for the "cross checks" in the grading operations. Each subsoiler averaged about 1 acre per day, and required



Fig. 2.—Subsoiling for Lucerne, Central Research Farm, Werribee.

six horses. The subsoiling tines required re-shaping daily, owing to the severe wear and tear with the stiff subsoil. The cost of the subsoiling was about 27s. 6d. to 30s. per acre.

Immediately the subsoiling was finished, attention was concentrated on getting the soil into a suitable tilth for grading operations. For this the spike roller, with harrow attached (Fig. 3), the spring-tooth cultivator, and the slicker or smoother (Fig. 5) proved extremely useful. When a suitable tilth was obtained, the land was ready for grading operations.

METHOD OF GRADING.

Thorough grading is the foundation of successful lucerne growing. Unless the land is properly graded, unequal distribution of water and patchy crops result. There can be little doubt that in our irrigation districts the growth of lucerne is dependent on the extent to which the water can be effectively controlled during the process of irrigating the crop. If the grading is done in such a way as to allow the water to flow evenly and regularly over the crop, heavy cuts of lucerne may be expected.

Main Check Banks.—The effectiveness of grading depends largely on the nature and amount of fall in the land. In most of the northern irrigation settlements the land is so level that very little grading is necessary. In other cases the surface is so uneven as to necessitate levelling and "checking."

Where the fall of the land is in one direction only the grading operations are relatively simple. The irrigation ditch runs along the highest contour of the field, and the main check banks at right angles to the contour lines (*vide* Grading contour plan, Fig. 1). If the fall is very gradual the "border" system of irrigation may be practised. In this case check banks are placed parallel to one another at intervals of 44 feet to 66 feet without any cross check banks.

If, however, the fall is considerable, as was the case at Werribee, the introduction of cross checks is necessary, in order to secure regular, uniform and controlled watering (Fig. 7).

In the case we are discussing, a contour plan of the 50 acres was obtained prior to subsoiling operations with an ordinary level and survey staff. This showed that the fall varied from $2\frac{1}{2}$ inches per chain to 6

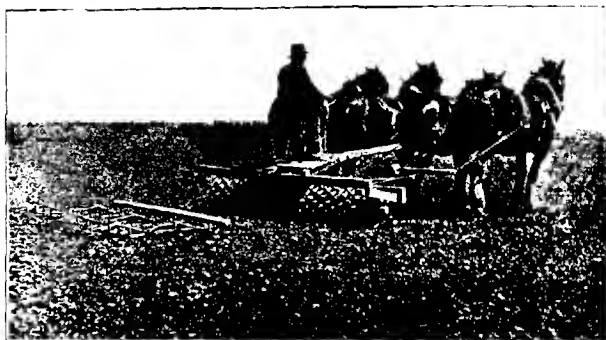


Fig. 3.—Working for Tilth Preparatory to Grading Operations.

inches per chain (*vide* Fig. 1). The contour plan provides the irrigator with the necessary data for determining the direction in which the distributing channels and check banks should be laid out. It will be noticed that the distributary ditches run practically parallel with the contour lines.

The check banks (indicated by faint lines) were for the most part placed 1 chain apart. On the area KMC/L, however, the "side fall" was considerable, and in order to avoid shifting too much soil on grading operations on this area, and thus exposing some of the raw crude subsoil, the main check banks were placed 33 feet apart. Reference to this contour plan will show that the fall averages 4 inches per chain.

Cross Checks.—The best fall for successful irrigation by flooding on land of ordinary permeability is about 1 inch to 100 running feet (1 inch to $1\frac{1}{2}$ chains). As the fall on this particular area considerably exceeded this, it was deemed necessary to use "cross checks" at intervals of 1 chain placed at right angles to the main check banks. Where the fall was

excessive (KMCL, Fig. 1), the cross checks, as well as the main checks, were set out at intervals of $\frac{1}{2}$ chain. Without this system of cross-checking it would not be possible to hold the water back and give each bay that thorough and uniform soaking which experience dictates to be necessary for the successful growth of lucerne. When finished, the paddock appears to be divided up like a chess-board, with bays 1 square chain in area. (Fig. 6).

That such a method of grading is successful in achieving its object—the even and uniform distribution of irrigation water—may be seen from Fig. 7. Note how the cross checks act in damming back the water on each "bay" until the whole area within the bay is thoroughly and uniformly soaked.

Putting up Check Banks.—A brief description may now be given of the method of putting up the check banks.

After the soil has been fined down with spike roller, harrow, cultivator, and "slicker," crowns are thrown up 1 chain apart, with a single-furrow plough, at right angles to the direction of subsoiling and at right angles to the fall of the land. In the early stages

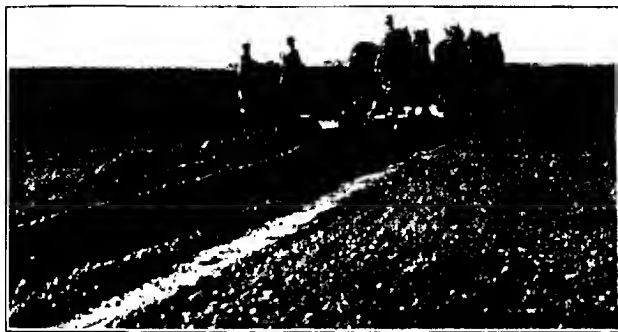


Fig 4.—Grading Operations. Throwing up Main Check Banks with Check Banker.

of the work a specially constructed check-banker was used. (Fig. 4). This implement consisted of two pieces of 12-in. by 2-in. oregon, shod on the inner face with steel and placed obliquely to one another, and fitted in the shape of a V, 8 feet across the front end and 2½ feet at the back. The two pieces of oregon were connected by iron bands. It was drawn by eight horses, and gathered up the soil for 4 feet on either side of the crown made by the plough, and forced it through the back part of the check-banker (vide Fig. 4). This implement would put up 10 to 12 miles of check banks a day. Latterly, however, it has been discarded, because experience has shown that the "slicker," by working on a good strong crown thrown up by a single or double furrow plough, could make an ideal check bank, with a minimum expenditure of labour and horseflesh, and, at the same time, effectively grade the land.

Indeed, the "slicker" (Fig. 5) has proved to be one of the most useful implements in grading the land and producing a fine tilth. The "slicker" consists of three pieces of 12-in. x 2-in. oregon, 12 feet long, connected by two pieces of 6-in. x 6-in. hardwood, and drawn by four

horses. The oregon is shod with 2-in. x $\frac{1}{2}$ -in. steel on the front faces. Two of the pieces are inclined at an angle of about 60 degrees to the horizontal, while the third piece is vertical and acts as a fulcrum. The operator, by moving forwards or backwards while the implement is moving, can gradually "collect" or "pay out" the soil at will, and so remove inequalities of the surface. By careful manipulation the "slicker" will ride over the check banks, and build them up as firmly and regularly as can be done with a buckscraper. (Vide Fig. 5).

The implement may be constructed by a handy man at a cost of £2 or £3. At the points of intersection of the checks and cross checks small openings will be left in the banks. These need to be filled in with a shovel.

As lucerne, under favorable conditions, is likely to occupy the land for a decade or more, special care and attention should be given to the preliminary work of grading and seeding.

To secure a good "stand" of lucerne, the preliminary operations should leave the seed bed firm, finely divided, and moist, and the seed



Fig. 5.—Smoothing the Check Banks with Slickers.

SEEDING AND INOCULATION.

should be sown shallow on warm, moist soil. No effort should be spared in securing a thoroughly firmed and compact seed bed. The spike roller harrows, springtooth cultivator, and slicker, used in rapid succession, will assist materially in securing this condition of the seed bed.

Time to Sow.—The best time to sow lucerne varies with the district. At Werribee lucerne has given good results sown either in autumn or in the spring. On the whole, however, spring sowing appears to be more favorable when lucerne is sown on irrigated land.

It must be remembered that lucerne is rather delicate in the early stages of growth, and makes relatively slow progress the first season. At this stage it is very susceptible to competition with weeds. But as soon as its roots penetrate the subsoil it will crowd out all competitors, exterminate weeds, *e.g.*, hoary cress (*Lepidium draba*), which prove very troublesome under ordinary cultural conditions.

If sown in the autumn, frosts may play havoc with it, and if the seed bed is not thoroughly clean, the "stand" may suffer from competition with cape weed, sorrel, which grow faster in winter-time than does young lucerne. Under these circumstances, better results would be obtained by

keeping the weeds in subjection by cultivating the soil during winter and sowing the lucerne in the spring. With spring sowing on irrigated land, the lucerne comes away nicely and has a better chance of getting ahead of the weeds.

The latter end of August and early September appears to give best results in districts similar to Werribee, though in certain cases sowing as late as October and November have given very favorable results, where moisture conditions of the soil are favorable to rapid germination.

Quantity of Seed per Acre.—So far as the quantity of seed required per acre is concerned, much depends on (1) the vitality of the seed, *e.g.*, its germinating capacity, (2) the cleanliness and fineness of the seed bed, (3) depth and manner in which the seed is sown, and (4) whether the seed bed is moist enough.

If the lucerne seed is sown deep a large proportion usually fails to germinate, and more seed is required than if sown shallow. Again, if the seed bed is cloddy and not well fined and firmed, more seed will be required to give an ideal stand.



Fig. 6.—Grading Operations completed, showing Arrangement of Main and Subsidiary Check Banks.

At Werribee, tests were made with Hunter River lucerne seed with seedings ranging from 6 lbs. to 21 lbs. per acre. From these tests it appears that the best seeding lies between 12 lbs. to 18 lbs. per acre, though smaller seedings have given perfectly satisfactory "stands." In our practice we have adopted 16 lbs. per acre as a suitable seed allowance, and drill one-half — 8 lbs.—one way and 8 lbs. at right angles.

The seed may be sown with an ordinary grain drill by mixing the requisite quantity of seed with the fertilizer (say, superphosphate), and sowing the mixture through the manure box at the rate of 16 lbs. of seed and $1\frac{1}{2}$ cwt. superphosphate per acre. The spouts should be taken off, and the seed and manure allowed to drop from the drill on to the ground. This insures that the seed is sown shallow. Care should be taken to mix the manure and seed immediately before sowing, as superphosphate tends to interfere with the germination of certain small seeds (particularly rape) if mixed too long before sowing.

The seed should then be brushed in either with brush harrows or a light roller or harrows.

Inoculating the Soil.—The question of inoculating the soil may be mentioned here. As is well known, lucerne belongs to a family of plants (*leguminosae*) which have the power of obtaining the bulk of the nitrogen they require from the air. Other plants can only secure the nitrogen essential for their growth from the soil. If the roots of lucerne, beans, clover, or any member of the pea family or plants be pulled up and examined, the presence of curious wart-like nodules will be seen growing on the roots of healthy plants. These nodules were shown by Hellriegel to be the homes of millions of bacteria, and the nodules are really factories where these bacteria store up the nitrogen of the air for the use of the plant, receiving in exchange sugary and carbonaceous materials from the plant.

This is the reason for the wonderful renovating effect of the leguminous plants on the soil. Lucerne has this renovating effect. It fixes in its roots and subsequently adds to the soil the expensive nitrogen obtained from the inexhaustible stores in the air by means of the bacteria living symbiotically on its roots. Now, if lucerne is sown on soil devoid of the particular bacteria which cause the formation of these nodules, then its growth may prove unsatisfactory and unhealthy. In some soils these bacteria are wanting. Consequently, if they are not introduced the growth of lucerne will not be healthy and vigorous. Generally speaking, if lucerne does not possess a deep green colour, and if on examination the roots do not reveal the presence of nodules, the absence of these bacteria may be suspected. We need not here enter into a discussion as to the merits of the many methods of inoculating the soil with the requisite bacteria. It will suffice to say that the most practical method is to secure some soil from an old lucerne field, in which the lucerne has developed nodules freely. In the case of the soil at Werribee, the inoculation was carried out by securing soil mixed with lucerne roots from old lucerne fields at Bacchus Marsh, and mixing this soil with the seed and fertilizer at the rate of 2 cwt. of inoculated soil per acre.

It appears from the results at Werribee that it is not necessary to inoculate the *whole field*. If one portion is thoroughly inoculated, the remainder soon becomes inoculated from the irrigation water flowing over the field, by the carrying of soil from one place to another with implements, stock, and persons.

The difference between the inoculated and non-inoculated plots at Werribee was very marked two years ago. These differences have since almost completely disappeared, owing most probably to the irrigation water conveying the requisite bacteria from the original inoculated portions to the non-inoculated parts, and thus bringing about the inoculation of the whole area.

Variety of Seed to Sow.—In view of the permanent character of the lucerne crop, the question of variety of seed to sow is far more important to the lucerne grower than is the choice of variety to the wheat-grower.

Curiously enough, the varieties of lucerne seed sold on the Melbourne market are for the most part named after the country in which they originated. Thus we have Peruvian, Patagonian, French Provence, Arabian, Spanish, Turkestan varieties figuring prominently in seedsmen's catalogues.

The Hunter River and Tamworth varieties are supposed to be acclimatized forms of Provence seed. The best all-round variety is undoubtedly Hunter River or Tamworth lucerne. It has given consistently heavy yields throughout the whole of the tests. Peruvian and

Arabian are noteworthy as good winter growers, and Patagonian—a recently introduced type—is likely to prove a useful variety. Turkestan has not done well at Werribee, though it appears to do very well at the Sparrovale Farm, Geelong.

There is certainly a wide and useful field of work in selecting and breeding good strains of lucerne from the complex medley of types that can be isolated in any of the so-called "varieties."

FERTILIZERS.

The use of superphosphate in small dressings has become so universal a practice with wheat and cereal growers in this State that one might be inclined to argue that small applications of phosphate would equally serve the lucerne crop.

Liming the Crop.—But there are several points of difference between the requirements of lucerne and the requirements of wheat. Lucerne being a leguminous plant, and able to obtain what nitrogen it requires from the air, does not need to be supplied with this most expensive plant food. But it can only obtain these supplies provided the soil is in such a condition as to favour the free development of those bacteria on its



Fig. 7.—Irrigation, showing how Cross Check Banks assist in obtaining an even Distribution of Water.

roots which were shown to be the cause of nitrogen fixation. Consequently it is of the utmost importance to see that the soil conditions are most favorable for this process of nitrogen fixation. For this reason lucerne will only thrive to perfection in soils that are neutral or slightly alkaline in reaction. If the soil is sour or acid in character, as is evidenced by the free growth of sorrel, dock, plaitain, &c., an application of lime is essential to bring the soil into good condition. Soils that have been cropped with superphosphate for long periods, badly drained soils, and virgin lands rich in organic matter are most likely to be acid in character, and requiring a dose of lime as a corrective. Lucerne, as indeed all leguminosæ, are lime-loving plants, and thrive best in soils containing naturally a high percentage of this ingredient.

We need not stop to consider the many benefits of liming lands. These were fully discussed in Bulletin No. 19, published by this Department, copies of which will be forwarded to any interested. It will merely suffice to say that the lime assists in liberating plant food, especially potash and phosphates, improves the physical and mechanical condition of the soil and provides a suitable base for the beneficial operations of the soil bacteria.

With the exception of the black soils of the Wimmera, and the limestone soils of the Mallee, there are very few Victorian soils that would not favorably respond to the application of lime in lucerne growing under irrigation.

The bulk field at Werribee have been treated with 1 ton of lime (ground lime containing about 92 per cent. of CaO) per acre at the completion of grading and prior to seeding. This lime was sown with a Jack Lime Distributor and lightly harrowed in. Plots have been laid out to test the effect of ground shell, gypsum, ground limestone, burnt and slacked lime in varying quantities applied as top-dressing to established lucerne crops, but as the top-dressings were only applied in July, 1914, insufficient time has elapsed for recording any results.

So far as potassic manures are concerned, lucerne, as is well known, responds markedly to these, but it appears to be sounder practice to liberate the necessary potash from the soil by adding lime and gypsum rather than to apply them in the expensive form of sulphate and muriate of potash, especially in view of the comparative richness of our Victorian soils in potash.

Nitrogenous Manures, as explained above, should be unnecessary, since lucerne has the power provided the soil conditions are favorable to obtain the nitrogen required from the air.

Phosphatic Manures are essential to lucerne growing, in view of the large quantity of phosphates removed by the crop, and the admitted poverty of the average Australian soils in phosphates.

The lucerne-grower is advised to be more generous in his allowance of artificial fertilizer than is the wheat-grower. The latter is limited to small dressings on account of comparatively small rainfall. The lucerne-grower, however, who is depending on irrigation can use with profit far heavier dressings of artificials than can be profitably used under dry farming conditions. Consequently, a substantial dressing of superphosphate at seeding time, and a regular top-dressing of phosphates every winter or every alternate winter is advisable in lucerne growing under irrigation. The wheat-grower is compelled to use water soluble phosphates, in view of the scanty rainfall. The lucerne-grower, with irrigation, may find basic slag, bonedust, phosphatic guanos of advantage as top-dressings. Superphosphate should be chosen to sow with the seed, however, as under our conditions it gives the young plants a vigorous start, and forces the growth for the first year. Of all the manures that can be used for lucerne there is none that will give such results as heavy top-dressings of stable manure. The stable manure is not only a general manure—supplying the lucerne with every plant food required—but its mechanical action on the soil in keeping it open, allowing free access of air to the roots, its biological action in stimulating the soil bacteria, as well as its mulching effect makes it superior to all other fertilizers.

II. Results of Tests.

1. *Bulk Lucerne Tests*.—The first block of 15 acres was sown at Werribee on 25th September, 1912. The germination was satisfactory, and the young plants made good progress. On 6th to 9th November—six weeks after seeding—the first irrigation was given. A spell of hot weather, and the comparative absence of subsoil moisture, owing to a dry winter, were responsible for the application of the water so early in the season.

Three cuttings were obtained during the first season:—(1) 6th January, 1913; (2) 26th March, 1913; and (3) 5th May, 1913. During the season water was applied three times:—(1) 6th to 9th November, 1912; (2) 15th to 17th January, 1913; (3) 8th to 10th April, 1913. As the weighbridge had not been installed as yet, no data was obtained regarding the weight of hay from these cuts. In July 850 ewes and lambs were grazed on the 15 acres for eight days, and the field was then cultivated both ways with a spiked disc lucerne renovator.

During the second season the cuttings were weighed load by load over the weighbridge. In order to secure exact data samples of the hay were taken from each load, and the amount of moisture determined. The results were then reduced to a uniform basis of commercial hay possessing 15 per cent. of moisture and 85 per cent. of dry matter.

Table I. gives a summarized statement of the weight of hay obtained.

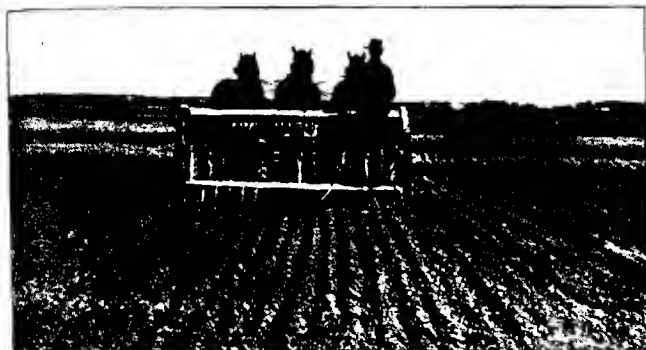


Fig. 8.—Sowing the Inoculated Seed and Fertiliser.

TABLE I.

SUMMARY OF WEIGHT OF LUCERNE HAY CUT FROM BULK FIELD, SEASON 1913-14.

No. of cutting	Date of cutting.	Average Cut.	Total Yield of Hay.	Yield of Commercial Hay per acre.
			tons cwt. qrs. lbs.	cwt.
First	30th Sept., 1913	15 00	12 0 0 0	16
Second	15th Nov., 1913	15 00	16 1 1 0	21½
Third	29th Dec., 1913	13 33	16 14 0 10	25½
Fourth	30th Feb., 1914	13 35	16 15 0 10	26½
Fifth	10th Mar., 1914	12 02	15 10 0 18	23½
Sixth	20th Apr., 1914	14 77	11 4 0 5	15
Total per acre for Six Cuts			6 tons 9½ cwt.	

The above figures are calculated on a basis of commercial hay containing 85 per cent. of dry matter. A variable portion of the 15 acres was used subsequently to 1st December, 1913, for green feed for cows. This was not included in the weights and calculations given above.

During the present season (1914-15) three cuts have been obtained up to the present (7th January). The second year's results promised early in the season to eclipse those of the first year, as the plants had thickened up during the winter, and the general growth was eminently satisfactory. This applied especially to the new lucerne sown in September, 1913. Thus the first cut from an area of 26 acres of young lucerne gave 32 tons $5\frac{1}{2}$ cwt. of commercial hay, weighed over the bridge, a yield of $24\frac{1}{2}$ cwt. per acre. Again, the older lucerne, sown in September, 1912, yielded, $20\frac{1}{2}$ cwt. for the first cut, as against a yield of 16 cwt. for the corresponding cut the previous year. These expectations, however, were short lived. Owing to the shortage of water in the Pyke's Creek reservoir no water was available for irrigation purposes at Werribee after 26th September, 1914, till the end of the year, when



Fig. 9.—View of Lucerne Field, showing Lucerne ready for Cutting.

an opportune fall of rain on December 28th put sufficient water in the Werribee River to supply our requirements. Had water been available during this dry period of over three months, it is safe to say that the figures for the previous season would easily have been eclipsed, and between 7 and 8 tons of hay per acre realized for the season.

As it was, the yield for the first three cuts of old lucerne (15 acres) was—

First cut, 9th to 12th October, 1914, $20\frac{1}{2}$ cwt. per acre.

Second cut, 5th to 7th December, 1914, $16\frac{1}{2}$ cwt. per acre.

Third cut, 4th January, 1915, $22\frac{1}{2}$ cwt. per acre.

Total for first half of season, $59\frac{1}{2}$ cwt. per acre.

It is probable that three more cuts will be obtained before the end of the season.

2. *Variety Lucerne Tests.*—Portion of the area of 15 acres sown in September, 1912, was devoted to variety trials to determine their value for hay production. As with the bulk field, six cuttings were obtained, but, unfortunately, owing to lack of facilities and pressure of work the weights of the first two cuts were not taken. The remaining four cuts were, however, weighed, and they afford a fairly reliable indication of the value of the different varieties under conditions similar to those that obtain at Werribee. The results are given in Table II.

TABLE II.
SHOWING WEIGHT OF LUCERNE HAY OBTAINED FROM VARIETY LUCERNE PLOTS, WERRIBEE, 1913-14.

Variety.	1st Cut.	2nd Cut.	3rd Cut.	4th Cut.	5th Cut.	6th Cut.	Average Cut for Season 1913.
	Weights not taken.	Weights not taken.	cwt.	cwt.	cwt.	cwt.	cwt.
Arabian	16½	29½	24½	8½	19½
French Provence	16½	25½	24½	9½	19
Turkestan	11½	16½	17	1½	11½
Peruvian	13½	23	19½	8	16
Hungarian	16½	22½	20½	8	17
Spanish	12	18	21½	8	14½
Tamworth	25½	26½	25½	18	24

Six cuts were obtained from each variety, but the average weight per cut varied very considerably. Tamworth seed gave by far the heaviest cutting, followed by Arabian and French Provence, while the results from Turkestan seed were the least satisfactory of all.

3. *Rate Seeding and Fertilizing Trials.*—These formed part of an area of 35 acres sown with Tamworth lucerne in 1913. More time was available for the preparatory work than was the case of the area sown in 1912, and consequently the results, as judged by weight of crop produced, are rather better.

The paddock (35 acres) was seeded on 5th to 8th September, 1913, and during the first season yielded three cuts, which were utilized with other green forage for silage purposes.

During the present season three cuts have been obtained. Early in the season this lucerne field promised to give most prolific returns, but owing to the failure of the Pyke's Creek scheme no irrigation water was applied from 24th September to 29th December—a period of over three months. The first cut was exceptionally heavy, being over 50 per cent. heavier than the corresponding cut for last season, but owing to the failure of the water supply, due to the droughty season, the second and third cuts, which were grown without irrigation, showed, as might have been anticipated, a considerable falling off.

Table III. summarizes the results.

TABLE III.

PRELIMINARY RESULTS, WERRIBEE LUCERNE TRIALS, 1914-15.
Comprising Rate Seeding, Lime and Fertilizer Trials, and Inoculation Tests.

Details of Plot.	Oct. 9th. 1st Cut.	Nov. 30th. 2nd Cut.	Jan. 5th. 3rd Cut.	Total Cut for First Half of Season. cwt.
(1) RATE OF SEEDING TRIALS—	cwt. *	cwt. †	cwt. †	cwt.
Plot 1. Tanworth lucerne, 6 lbs. per acre	32.3	18.4	26.3	77.0
.. 2. Tanworth lucerne, 9 lbs. per acre	28.3	17.7	21.8	67.8
.. 3. Tanworth lucerne, 12 lbs. per acre	34	17.5	28.3	79.8
.. 4. Tanworth lucerne, 15 lbs. per acre	33.1	17.7	26.4	77.4
.. 5. Tanworth lucerne, 18 lbs. per acre	34.5	17.4	25.3	77.2
.. 6. Tanworth lucerne, 21 lbs. per acre	33.4	18.9	24.5	76.8
(2) FERTILIZER TRIALS—				
Plot 1. Lime, 20 cwt., super, 2 cwt., blood manure 1 cwt.	35.4	19.3	30.5	85.2
.. 2. Lime, 40 cwt., super, 2 cwt.	28.3	16.0	30.7	75.0
.. 3. Lime, 20 cwt., stable manure, 10 tons per acre	34.6	21.3	27.1	83.0
.. 4. Lime, 20 cwt., super, 2 cwt., nitrate of soda, 1 cwt.	37.5	15.1	35.6	88.5
.. 5. Lime, 20 cwt., super, 2 cwt., sulphate of potash, 1 cwt.	32.9	18.1	28.0	79.0
.. 6. Lime, 20 cwt.	35.3	15.3	26.2	76.8
.. 7. Lime, 20 cwt., bone-dust, 2 cwt.	31.7	18.8	27.2	77.7
.. 8. Lime, 20 cwt., Thomas phosphate, 2 cwt.	34.2	15.2	27.5	76.9
.. 9. Lime, 20 cwt., superphosphates 2 cwt.	33.0	17.3	27.0	77.3
.. 10. Ground limestone, 36 cwt.	32.1	12.2	26.3	70.6
.. 11. Nil	27.4	15.1	25.9	68.4
.. 12. Superphosphates 2 cwt.	33.0	17.3	26.5	76.8
(3) INOCULATION AND LIMING TESTS—				
Plot 1. Not limed, not inoculated	33.1	10.9	26.9	70.9
.. 2. Not limed, inoculated with 1 ton lucerne soil	30.3	13.5	26.1	69.9
.. 3. Not limed, inoculated with 2 cwt. lucerne soil	28.5	15.1	26.2	69.8
.. 4. Limed, not inoculated	29.1	10.5	26.4	66.0
.. 5. Limed, inoculated with 1 ton lucerne soil	30.0	13.7	26.0	69.7
.. 6. Limed, inoculated with 2 cwt. lucerne soil	31.7	13.7	26.1	71.5

COMMENT ON PRELIMINARY TESTS.

In carrying out the weighing and sampling of hay from these plots, the greatest care has been taken to obtain data for a uniform basis of comparison.

Every load of hay brought to the weighbridge was carefully sampled, and the samples immediately forwarded in hermetically sealed recep-

All returns given in terms of commercial hay containing 82 per cent. dry matter.
 Rainfall Sept. 1914, 1.32 in.; Oct. 0.12 in.; Nov. 1.65 in.; Dec. 3.04 in.
 * Irrigated. † 2nd and 3rd cuts grown without irrigation.

tacles to the Agricultural Laboratory for the determination of the dry matter. The figures given in the tables represent the weight of hay reduced to the basis of commercial lucerne hay containing 85 per cent. of dry matter.

It is far too early to draw deductions from the results of the various plots, and the possible bearing of the results on practice. It will be time enough to draw such generalisations when more data has been accumulated. Meanwhile, there are features of interest in these tests that are worth pointing out, if only to see whether later experience will confirm or modify what now seems reasonably true.

1. *Regarding the Prolificacy of Irrigated Lucerne at Werribee.*—No one would claim that the land on which this lucerne was grown was by any means ideal lucerne soil. Nor could it be said that the land is much better than the average irrigation land on the Werribee Estate. Yet the return from a 15-acre block averaged $6\frac{1}{2}$ tons of commercial hay in the second year of growth, besides providing considerable winter grazing for sheep. The yield for the third season promises to at least equal that of the second year, in spite of the fact that no water was received for irrigation purposes from 24th September to 28th December, 1914—a period of over three months. Had the water been available during this period, it is reasonable to expect that the yield for the third season would have considerably exceeded that of the second. Again, the average yields from the experimental plots (sown September, 1913) have for the present season exceeded $3\frac{3}{4}$ tons per acre, though probably three cuttings still remain to be garnered, and in spite of the fact that these plots did not receive any water for over three months.

From this it is apparent that irrigated lucerne sown under conditions similar to those at Werribee promises to be a most prolific and profitable crop, and the completion of the Exford weir should enable the Werribee Irrigation Estate to become a highly prosperous settlement.

2. *Effect of Soil Inoculation.*—With regard to the inoculation tests, a comparison of the six plots will reveal that during the second season of growth there is very little difference between the inoculated and the corresponding non-inoculated plots. The first year, however, the differences were very marked. One of the most striking ocular demonstrations at Werribee during the summer of 1912 was the difference in the appearance of four 2½-acre blocks of lucerne, two of which were inoculated with lucerne soil from Bacchus Marsh, and two of which were not inoculated. As Autumn and Winter approached, the differences became less marked, and in the second season they had disappeared altogether. So with these smaller plots: at first the inoculated plots were a rich healthy green, and examination of the young roots showed that nodules were forming freely. The non-inoculated plots showed in the early stages a pale yellowish nutthrift appearance, but as the season wore on the difference between the plots gradually disappeared. It can only be surmised that the non-inoculated plots became slowly inoculated through the medium of the irrigation water as it flowed from plot to plot and from field to field, and this is borne out by the appearance of nodules on the non-inoculated plots in late Autumn following the seeding.

The point to note, therefore, is that inoculation should not be necessary in a district where successful lucerne growing under irrigation has been carried on for a time, and that, in cases where lucerne has never

been sown on a farm or in a district before, an effective inoculation of a relatively small area should soon lead to the inoculation of the whole area, by the carrying of the bacteria by air, dust, irrigation water, stock, and farm implements.

3. *The Effect of Various Fertilisers.*—The results of the fertiliser tests are of interest. It will be noted that by far the highest crops were obtained by using nitrogenous manures. In view of what has been said already regarding the ability of lucerne to obtain its nitrogen from the air, this may perhaps seem strange. But the explanation is simple enough. To secure the necessary nitrogen from the air, energy must be expended by the bacteria living on the lucerne roots, and by the lucerne in providing food for the bacteria. If you supply the nitrogen in the form of manure, or provide an excess of it in the soil, then the lucerne will prefer to use what is so supplied, instead of extracting it with the expenditure of more or less energy from the air.



Fig. 10.—Harvesting a 50 Acre Block of Lucerne at Central Research Farm, Werribee.

Generally, it is not considered good farming practice to apply nitrogenous manures to a leguminous crop like lucerne. It is considered proper that the lucerne should be forced to obtain its nitrogen from the inexhaustible supplies in the air. But, if the farmer can secure a handsome profit by applying a nitrogenous manure to a legume is not be justified in doing so? Examination of the results of the fertiliser trials will show that the plots dressed with nitrate of soda, blood manure and farmyard manure have yielded considerably in advance of the remaining manures.

If these plots continue to stand out as prominently in the next three cuts as they have in the first three, the question of applying nitrogenous manures may become of immediate practical importance.

Effect of Phosphatic Manures.—It appears from the results of these preliminary tests that superphosphate is the most effective of the phosphatic manures in the early stages of the lucerne. It has given the best

results where it has been applied by itself. When applied with lime the crop yields appear to have been depressed. Thus—

Plot 11.—No manure	...	...	68.4 cwt.
Plot 12.—Super. 2 cwt.	...	...	79.8 cwt.
Plot 9.—Super. 2 cwt. x 20 cwt. lime	...	...	77.3 cwt.
Plot 2.—Super. 2 cwt. x 40 cwt. lime	...	...	75.0 cwt.

Probably the addition of lime has led to the reversion of the water soluble phosphates of the super. to insoluble forms and thus rendered its phosphates temporarily ineffective.

Lime.—So far as the action of lime is concerned, it appears that it has most immediate effect when applied as slaked lime. Thus, 20 cwt. of lime applied in the form of slaked lime has given a far better crop than 36 cwt. of ground limestone containing the same quantity of lime. Thus—

Plot 11.—No manure	...	...	68.4 cwt.
Plot 10.—Ground limestone, 36 cwt.	...	...	70.6 cwt.
Plot 6.—Lime, 20 cwt.	...	...	76.8 cwt.

This, of course, might possibly have been expected. Ground limestone acts very slowly on the soil, but its effect is nevertheless very lasting, and some time must elapse before its full effect becomes noticeable on the crop. Again, a comparison of Plots 6, 7, 8 and 9, which are practically identical in yield, would seem to show that a good dressing of lime has a considerable effect in liberating phosphates from the soil, and thus dispensing to some extent with the need for their application. This is very different, however, from our experience with wheat. With wheat, phosphates are always and absolutely necessary for successful crops, no matter how much lime is applied to the soil. But it must be remembered that the lucerne is an irrigated crop and receives on an average 24 inches of applied water in addition to the normal rainfall. Consequently the soil conditions in the case of lucerne and wheat are entirely different. The one is grown on a 16-inch rainfall, the other on what is equivalent to a 40-inch rainfall. Under these latter circumstances it would naturally be expected that lime would act more efficiently on the lucerne land than on the wheat soils.

More investigational work is necessary before a definite pronouncement on this interesting point is possible, and steps have been taken since the laying down of these plots, to further test the effects of sea-shells, ground limestone, gypsum and slaked lime, applied in different quantities with and without phosphates, on established lucerne plots.

Rate of Seeding and Variety Lucerne Trials.—The results of the rate of seeding trials emphasizes how small a seeding may give a good stand if the soil and weather conditions are favorable at the time of sowing. The six plots varying in seeding allowances from 6 to 21 lbs., were sown on a very fine seed bed, on 5th September, 1913. Several timely quarter-inch showers at intervals of a week followed by a good soaking rain kept the surface moist and enabled a good germination to take place.

Plot 1 (6 lbs. of seed) has given a very satisfactory stand, and is now almost as good as any of the heavier seedings, but the favorable character of the seeding season must be borne in mind. The plot sown with 12 lbs. per acre has so far given the best return, whilst there is little to choose between the 15 and 18 lbs. Sixteen pounds of seed per acre is the allowance we have adopted in practice, and all areas seeded with

this quantity have given excellent stands. Weather and soil conditions at time of seeding determine whether more or less than this average quantity should be sown.

So far as Variety Trials are concerned, Tamworth and Hunter River seed has given better results than the imported types. This is supposed to be an acclimatised form of French Provence seed, and it would be interesting to know how acclimatised seed of these different varieties raised at Werribee would compare with the imported seed sown under similar conditions. Judging from the experience obtained with wheat varieties, the results should be highly satisfactory, and arrangements are being made to carry out such trials at an early date.

III. Notes on Treatment of Irrigated Lucerne.

With lucerne sown in the spring on well-graded land in good tilth, the germination should, in most seasons, be satisfactory. The subsoil being well moistened by winter rains, spring showers will normally enable germination to take place evenly, and allow the young plants to strike down towards the moist subsoil. But if the soil and subsoil be not thoroughly moist at seeding it would be better either to delay the seeding or to irrigate the land, and work it down rapidly as soon as teams can be got on to the soil prior to sowing.

If water be applied during the period of germination to "bring up the seed," the "stand" will most probably be poor, especially on clay soil, owing to the caking action of the fine surface soil, and the inability of the young lucerne plant to force its way through the rapidly-drying crust. A good "stand" is essential for a heavy crop, and for ease and economy in watering.

The first irrigation of young lucerne should be delayed as long as possible on our stiff lands, in order to give the rain and conserved soil moisture the fullest opportunity for bringing on the young plants. Avoid grazing the young lucerne with stock during the first season. Once the plant gets established judicious grazing may prove beneficial, but cutting is recommended through the first summer. The first season's growth will rarely give a heavy crop, or good quality hay. It may be used for feeding stock or conversion with bulky forage into silage.

Winter Treatment.—After the last cut, the winter weeds will probably come away very fast, and make headway while the lucerne lies dormant.

During July and August, therefore, sheep may be employed to graze off the winter growth, and clean up the weeds. It is astonishing how well sheep and lambs do on this winter growth. They will clean up the weeds far better than any cultivator, and their droppings will materially help to improve the fertility of the soil.

During August the sheep are removed, and the whole area should be scarified and cross scarified with suitable lucerne renovators. Either the spiked disc, the tine cultivator or even the ordinary disc may be used for this purpose. Such cultivation will not, as some suppose, injure the stand, but the splitting of the crowns caused by judicious discing will lead to increased stooling, whilst the aeration received by the roots will stimulate fixation of nitrogen, and lead to early and

rapid spring growth. Finally the opening up of the soil will enable the spring rains to percolate more readily instead of lying about on the surface.

These rains will usually mellow down clods formed during the winter cultivation and give the mowers and rakes a good surface to work on. If, however, the surface is left too cloddy the roller may be used to advantage to avoid gathering lumps of soil with the first cut.

If it is deemed advisable to top dress or apply lime to the established crop it may be done with advantage during this comparatively dormant period of the lucerne, either prior or subsequent to cultivation. In the latter case the harrows may be used to work the fertilizer into the soil.

Winter Irrigation.—The question now arises as to whether the lucerne should be watered in the winter months. In normal seasons the winter rainfall in most districts is sufficient to saturate the soil, in which case winter irrigation would be both unnecessary and harmful.

In such a season as we have just passed through, however, winter irrigation would be decidedly advantageous. The danger in winter irrigation is, of course, the effect of the cold water on the growth of



Fig. 11.—Harvesting Lucerne on Fertiliser Plots, Werribee.

the crop. Germination and plant growth is suspended at 41 deg. F., and if the temperature of the water is much below this, it will reduce the body of the soil below the temperature at which growth is possible.

If, however, the water be above 50 deg. F., no danger to the growing crop need be apprehended. Water was applied to the whole of the lucerne, permanent grass, clover fields, and irrigated cereals at Werribee on 5th to 7th August of last year with markedly beneficial results. As is well known the capacity of water for heat is nearly five times greater than that of soil. The mean temperature of the irrigation water on 6th August was 51 deg. F., whilst that of the soil 42.7 deg. F., or 1.7 deg. F. above the temperature at which growth is suspended. In this case the water actually *raised* the temperature of the first 6 inches of soil over 6 deg. F., and resulted in a marked stimulation of the growth of all the crops.

With regard to summer irrigation, no hard and fast rules can be laid down as to frequency, time of irrigation, and quantity of water to apply. Obviously the nature of the season, the amount and distribution of the summer rain and the condition of the crop will be the determining factors. The skilful irrigator will be guided by the appearance

of his crop. Well-grown lucerne has broad, dark-emerald leaves and sappy succulent stems. Lucerne in need of water shows a peculiar characteristic dull green tinge, stunted small leaves with more or less whitish bloom, tough fibrous stems, and tends to flower prematurely and irregularly. Lucerne, more than any other crop, requires large quantities of water to keep it at its maximum development. In a set of preliminary tests at the Central Research Farm to determine the water requirements of our various farm crops, it would appear that lucerne requires at least 700 tons of water to pass through its leaves to produce 1 ton of dry hay. That is to say, 1 acre of lucerne must have at least 7 inches of water passing through the crop in order to produce 1 ton of hay. Obviously, large crops cannot be expected without heavy applications of water.

Some of our irrigated lands are debarred from producing heavy crops because of the practical difficulty of getting the soil to take sufficient water. The subsoils are so close and impermeable that water will only penetrate slowly and to comparatively shallow depths on these



FIG. 12.—Cutting of Lucerne grown without Irrigation, 1914.
Top Dressing Plots in Background.

soils. During irrigation water sinks slowly to a certain depth; immediately irrigation ceases the water begins to evaporate at the surface, capillarity becomes active, and the soil begins to dry out. Such soils obviously need to be watered frequently to secure good crops, unless indeed, some steps are taken to keep the subsoils open by rational cultivation. Subsoiling the land before the sowing of the lucerne will materially assist percolation and allow of heavier applications of water. Cultivation immediately after harvesting is also recommended. Subsoiling preparatory to seeding, scarifying deeply every winter, and occasional summer cultivation will do much to improve the crop on such soils.

It was intended to test this season the comparative effect of water applied in 3-in., 4-in., 5-in., 6-in. applications at varying intervals on the growth of the crop, but the breakdown of the Pyke's Creek water supply has caused these tests to be delayed for at least a year.

A brief word may be said in regard to cutting and curing the hay

The most suitable time to cut lucerne for hay, if weather conditions permit, is when the field is just beginning to bloom. "One-tenth in bloom" is the signal for the lucerne-grower to commence cutting. If left much later than this the stalks begin to toughen, and loss of leaf is likely to result. The young growth at the crowns of the lucerne may be taken as a good guide. When these crowns begin to put forth young shoots, it is a plain indication that the overhead growth is slackening off, and cutting should commence.

The aim of the grower should be to secure hay with the maximum of leaf and the minimum of fibre.

As soon as the lucerne is cut with the mower the hay rake or tedder should be set at work, raking it into windrows (Fig. 10). The only exception is where the lucerne is wet either with dew or rain. In this case it should be left on the ground to dry off the external moisture, and then raked into windrows as soon as possible. In this way



Fig. 13.—Weighing the Lucerne from the Experimental Plots, Werribee.

good colour and leaf are retained. The leaves are by far the richest and most nutritive part of the plant, and care should be taken to retain them in the hay. On hot dry days the processes of mowing, raking, and cocking can hardly follow one another too quickly. Generally, however, the hay may be allowed to remain a few hours in the windrows before putting into the cocks. Generally the hay will be ready to stack in two or three days. In cool weather the time will be longer. If the hay is not thoroughly dry before stacking, heating may result, and the stack may become mouldy.

If the stems are at all sappy, or moisture can be wrung from them under pressure, stacking must be delayed. When the hay feels crisp in the hand, and yet pliable, it is in good condition for stacking.

ORCHARD AND GARDEN NOTES.

E. E. Pescott, F.L.S., Principal, School of Horticulture, Burnley.

The Orchard.

GREEN MANURE.

The benefits accruing from growing a cover crop for green manure are everywhere recognised. The crop should be planted as soon as possible after the early autumn rains have prepared the ground for the plough. As the crop makes no growth in winter, and very little in the spring-time, and as it is advisable to plough it in as early as possible in spring, a good and abundant growth in the autumn is advantageous; consequently, the earlier the crop is planted, the greater the amount of herbage there will be for manurial purposes.

The crop may be sown towards the end of February. A leguminous crop should be preferred before any other, owing to the amount of nitrogen which this class of plant contains. The sowing will need to be a plentiful one, as it is well to have a good dense growth. Field peas, tares, or vetches are generally sown for this purpose. In some instances the tick bean has also been used with good success. In ordinary orchard soils it is often advisable to sow 1 cwt. each of bonedust and superphosphate per acre, to stimulate the crop into a quick and good growth.

FUMIGATION.

Citrus and other evergreen trees that are attacked by scale insects should be freed from the scale at this time. Although spraying with such mixtures as resin compound, crude petroleum emulsion, lime sulphur emulsion will do good work in keeping scale insects in check, the only effective means is by fumigation. The trees are enclosed in a tent that will prevent the escape of any gas through its texture. The gas is generated inside the tent, and the tent is kept over the tree for a period of from one-half to three-quarters of an hour. The best remedy is hydrocyanic acid gas, which is generated by placing cyanide of potassium in a mixture of sulphuric acid and water. As both the cyanide and gas are deadly poisons, every care should be taken in using them. The operator must take care that not the slightest portion of the fumes is breathed. Fumigation should be carried out at night-time, or on a cloudy day, and the foliage of the trees must be thoroughly dry.

YOUNG TREES.

Young trees of the citrus family should now be making a good, thrifty growth. The foliage should be glossy, and the general appearance a healthy one. Occasional light waterings, as well as a mulching of grass or of well-rotted manure, will be helpful to the trees.

Young deciduous fruit trees will also benefit by having a manure mulch, and, if it has not been previously done, unnecessary growths in the centre of the tree should be removed.

SPRAYING.

A spray with nicotine solution or with a resin wash may now be given for either woolly aphis or byrobia mite, but only after the crop has been gathered. If these pests are not very prevalent, the spraying may be left until winter, when a good red oil emulsion or a lime-sulphur spray may be given.

Vegetable Garden.

Celery crops will now be a prominent feature in the vegetable section. The seed may be sown from January to March, and succession plantings should be carried out occasionally during these months. The growth of celery should be quick; a fair supply of water and a good, rich, loose soil are helpful to its growth. The plants should be earthed up as they make growth.

Ample water will now be required in the vegetable garden. The surface should be kept well hoed, and mulchings of manure should be given wherever possible.

Cabbage, carrot, turnip, radish, lettuce, peas, cauliflower, &c., seeds may now all be sown, and young plants from any seed beds may now be planted out.

Flower Garden.

The flower garden requires a maximum amount of water and of surface cultivation during the month of February. The season is generally a dry one, the air is hot and dry, and hot winds are sometimes prevalent; and it is impossible to expect that so many plants which are now flowering will put forth their best efforts without the aid of ample water and cultivation. The main autumn flowers—cannas, salvias, dahlias, pentstemons, chrysanthemums—and many plants of the herbaceous section are now in full flower or are preparing to furnish their blooms. These will all require ample moisture, and in the case of rapid growing succulent plants, such as the dahlia, a good mulching with stable or poultry manure is required. Flowering trees and shrubs, such as oleander, poinciana, virgilia, lagerstromia, acacia elata, and many others are now in full bloom, and if the gardener has room for any of these, they should be noted for future planting.

Delphiniums should have their old flowering stems cut down, so that they may give another succession of autumn blooms. The plant should be well mulched and watered after cutting the old stems.

Carnations may be layered, keeping the layers continually moist and cool until they root. Cuttings of all pelargoniums, zonal and regal, may now be planted, and seeds of perennial and hardy annuals may be sown. Included among the seeds to be sown are those of the sweet pea, wallflower, Iceland poppy, anemone, ranunculus, stock, and pansy.

Beds and plots for the planting of daffodils, hyacinths, and other spring flowering bulbs should be thoroughly dug and worked over, and the subsoil should receive a good soaking.

Chrysanthemums should be thinned out and staked, if this has not previously been done. The floral buds should be selected and all others pinched out, and the plants should then be fed whenever necessary.

All old flower heads should be removed from the rose bushes. In March the plants may be thinned out, manured, and generally prepared in anticipation of the crop of autumn blooms.

All shrubs and trees that have bloomed should have their old flowering stems and shoots thinned out, so as to start fresh growths for filling in spaces, and for next year's blooms.

IN reply to a correspondent, Mr. A. E. V. Richardson, M.A., B.Sc., Agricultural Superintendent, has furnished the following information:—

1. *Amount of seed per acre to produce highest results varies with many conditions, such as:—*

- (a) Stooling capacity of seed.
- (b) Variety of grain sown.
- (c) The tilth of the land and its freedom from weeds.
- (d) Whether sown early or late. The earlier the sowing the less seed is wanted.
- (e) Rainfall of district. The lower the rainfall the less the seed.

In Mallee 40-50 lbs., and Wimmera, 50-60 lbs. of seed per acre give best results. In the North-East, Central, and Western Districts, 60-70 lbs. of seed give best returns.

2. *The highest known number of stools per grain of wheat:—*

There are usually at least six, but there may be from two to several dozen, in extreme cases as many as fifty-two spikes have been observed. Time of seeding has great influence, for late sown wheat may not have time to stool.

3. *The highest number of grains per head:—*

Major Hallet, a noted wheat breeder, records that the best head of wheat examined by him contained 123 grains.

4. *Average number of grains to bushel:—Varies from 446,580 to 971,940.*

	Number of grains per—			
	lbs.		bushel.	
Wheat	10,500	.. 630,000
Barley	15,400	.. 862,400
Oats	20,000	.. 800,000

FOURTH VICTORIAN EGG-LAYING COMPETITION, BURNLEY, 1914-1915.

MONTHLY REPORT ENDING 14TH JANUARY, 1915.

The rainfall for the month totalled 311 points. This, coupled with the fact that the thermometer registered as low as 49 deg. on one occasion, and 50 to 52 on several mornings, affected the birds to some extent adversely. A number of birds were moulting, and broodies were numerous during the month.

The health of the birds is first class, and a good egg yield for this time of the year is being obtained.

A. HART,
Chief Poultry Expert.

FOURTH VICTORIAN EGG-LAYING COMPETITION, 1914-1915.

Commencing 15th April, 1914; concluding 14th April, 1915.

CONDUCTED AT BURNLEY SCHOOL OF HORTICULTURE.

Pen No. (6 Birds).	Breed.	Owner.	Eggs Laid during Competition.			Position in Competition.
			15th April to 14th Dec.	15th Dec. to 14th Jan.	Total to date—8 months.	
LIGHT BREEDS						
WET MASH.						
25	White Leghorns	J. H. Gill	1,163	141	1,304	1
36	"	E. A. Lawson	1,152	147	1,299	2
26	"	Mrs. H. Stevenson	1,064	153	1,217	3
9	"	J. J. West	1,054	138	1,192	4
16	"	A. R. Shuen	1,054	138	1,192	4
10	"	R. Hay	1,045	140	1,185	6
17	"	F. Dokkissen	1,007	136	1,143	7
4	"	Giddy and Son	985	144	1,129	8
19	"	Marville Poultry Farm	982	145	1,127	9
40	"	J. Selwabb	979	146	1,125	10
33	"	W. G. Osborne	1,006	117	1,123	11
11	"	C. J. Jackson	975	145	1,120	12
37	"	S. Brown	984	129	1,113	13
45	"	H. C. Brock	972	141	1,113	13
29	"	V. Little	971	133	1,104	15
35	"	W. Taterson	969	124	1,093	16
23	"	S. Huseumb	929	139	1,078	17
44	"	A. Ross	964	100	1,064	18
48	"	F. W. Irvine	929	138	1,067	19
1	"	F. G. O'Brien	913	144	1,057	20
18	"	K. Wadon	919	130	1,049	21
47	"	W. G. Swift	906	133	1,039	22
30	"	G. W. Robbins	891	144	1,035	23
22	"	B. Mitchell	871	143	1,014	24
24	"	C. Pyke	894	119	1,012	25
28	"	Cliffy Poultry Farm	897	113	1,010	26
20	"	A. W. Hall	892	155	1,047	27
34	"	W. A. Rennie	879	119	998	28
12	"	J. C. Armstrong	873	125	998	28
48	"	A. H. Mould	879	115	994	29
38	"	Bennett and Chapman	848	146	994	30
14	"	G. Hayman	854	136	990	32
8	"	F. C. Western	844	152	996	33
3	"	C. R. Jones	890	120	980	34
13	"	T. A. Pettigrove	867	109	976	35
42	"	H. Hagbury	833	126	959	36
18	"	E. W. Hippe	828	126	954	37
41	"	All-day Poultry Yards	810	136	946	38
32	"	Doncaster Poultry Farm	792	147	939	39
5	"	Glendell Bros.	810	119	928	40
31	"	A. Mowall	788	143	931	41
43	"	E. H. Bridge	797	132	929	42
21	"	G. Mayberry	741	143	884	43
39	"	R. A. Lewis	740	125	871	44
19	"	R. L. Appleford	720	137	866	45
27	"	A. Beer	719	122	841	46
7	"	F. G. Silberden	670	137	807	47
46	"	Walter M. Bayles	656	117	773	48
	"	B. Cohen	620	140	766	49
	"	C. L. Sharman	620	134	753	50
Total			44,397	6,681	51,078	

FOURTH VICTORIAN EGG-LAYING COMPETITION, 1914-1915—continued.

Pen No. (6 Birds).	Breed.	Owner.	Eggs Laid during Competition.			Position in Competition.
			15th April to 14th Dec.	15th Dec. to 14th Jan.	Total to date—8 months.	
LIGHT BREEDS—continued.						
DRY MASH.						
60	White Leghorns ..	W. N. O'Mullane ..	1,160	141	1,301	1
55	" ..	E. A. Lawson ..	1,116	138	1,254	2
63	" ..	W. G. Osburne ..	1,008	109	1,117	3
53	" ..	C. Lawson ..	982	111	1,093	4
51	" ..	Moritz Bros. ..	946	146	1,092	5
58	" ..	Miss L. Stewart ..	945	115	1,060	6
61	" ..	H. Hanbury ..	920	137	1,057	7
63	" ..	Hanslow Bros. ..	862	117	979	8
59	" ..	F. G. Silbereisen ..	819	154	973	9
68	" ..	E. W. Hippe ..	832	136	968	10
62	" ..	A. Greenhalgh ..	816	149	966	11
52	" ..	Myola Poultry Farm ..	817	121	938	12
64	" ..	G. Carter ..	801	123	924	13
70	" ..	W. H. Robbins ..	805	116	921	14
66	" ..	E. A. Carne ..	799	121	920	15
69	" ..	C. J. Beatty ..	775	127	902	16
57	" ..	J. Jackson ..	777	116	895	17
87	" ..	Walter M. Bayles ..	737	138	875	18
66	" ..	S. Brown ..	533	108	641	19
		Total ..	16,450	2,414	18,864	
HEAVY BREEDS.						
WET MASH.						
77	Black Orpingtons ..	J. McAllan ..	1,055	146	1,201	1
88	" ..	H. H. Pump ..	971	138	1,109	2
71	" ..	J. Ogden ..	976	128	1,104	3
89	" ..	Marville Poultry Farm ..	988	98	1,086	4
81	Rhode Island Reds ..	J. Mulgrove ..	910	127	1,037	5
81	Black Orpingtons ..	D. Fisher ..	899	102	1,001	6
82	" ..	J. H. Wright ..	891	100	991	7
76	" ..	W. P. Eckermann ..	851	120	971	8
87	" ..	A. Douglas ..	826	131	957	9
75	" ..	Fairdeal Poultry Farm ..	820	117	937	10
74	" ..	S. Brown ..	810	95	905	11
73	" ..	J. A. McKinnon ..	788	114	902	12
72	" ..	T. W. Foto ..	806	91	897	13
83	" ..	Cowan Bros. ..	752	86	838	14
85	Golden Wyandottes ..	J. C. Mickelburgh ..	696	87	601	15
78	Red Sussex ..	Jorgen Anderson ..	592	77	669	16
79	Barred Plyth. Rocks ..	Bennett and Chapman ..	540	92	632	17
86	Buff Wyandottes ..	W. G. Swift ..	405	68	473	18
		Total ..	14,186	1,865	16,051	
DRY MASH.						
100	Black Orpingtons ..	D. Fisher ..	875	88	966	1
90	" ..	J. H. Wright ..	819	91	912	2
97	" ..	Jas. McAllan ..	798	97	895	3
98	" ..	A. Greenhalgh ..	800	94	894	4
94	" ..	T. W. Foto ..	765	65	830	5
91	" ..	C. E. Graham ..	719	105	824	6
96	Rhode Island Reds ..	Myola Poultry Farm ..	693	111	807	7
92	Black Orpingtons ..	Fairdeal Poultry Farm ..	671	75	746	8
93	" ..	Myola Poultry Farm ..	654	94	747	9
99	White Plyth. Rocks ..	Mrs. G. R. Bald ..	530	92	622	10
95	" ..	C. L. Hewitt ..	377	72	449	11
		Total ..	7,696	1,109	8,805	

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